

Pragmatics and Prosody of Implicit Discourse
Relations: The Case of Restatement

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2006

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Acknowledgements

Writing a dissertation is a social thing, although it is not usually thought of in this way; and although it's just my name standing lonely on the front page, there is a whole crowd of people who have a share in this product of a few years of work. For all these years I have been especially looking forward to writing this section of my thesis where I can finally bring all those people on stage.

Proceeding chronologically, I would like to thank Paul King and Erhard Hinrichs without whose encouragement and initial support this whole project would not have started. But then, of course, the lion's share of credit goes to my advisors, Fritz Hamm and Dafydd Gibbon. I would like to thank Fritz Hamm especially for his admirable patience with my working style that has resisted any kind of rational control, his brilliant ability to understand problems I stumbled upon that no one else appeared to understand, and what is more, his knack to come up with short but informative answers exactly to the point, or just to hand me *the* paper I needed to read. Dafydd Gibbon, who joined this enterprise somewhat later, turned out to complement Fritz excellently. It was him who finally pushed me to start writing up, and he did a lot to also get me to finish writing up. Finally, next to my supervisors, I should mention Janina Radó whose contribution is difficult to define because it was more or less everything: looking through endless drafts and seeing not just typos but also the sense behind (or lack of it), giving feedback on talks, providing basic education in questions ranging from academic writing to psycholinguistic methodology, making tea when desperate, making tea when in a good mood, making brownies to go with the tea (concerning tea, Frank Kügler gets special credit, too), and so on, and so on.

Other people have done their part as well. I profited a lot from discussions with Hubert Truckenbrodt, Robert van Rooij and Henk Zeevat. I would like to thank Arnim von Stechow and Reinhard Blutner for useful pointers that brought my work forward at critical points. The new academic environment that I was exposed to at the University of Postdam halfway through the project played a very positive role, too. I am grateful to all the participants of the Discourse and Dialogue Colloquium for their comments on all the parts of my thesis that they were subjected to with persistent regularity, while special thanks go out to David Schlangen and special special thanks to Elke Kasimir, who has (unvoluntarily) changed my world. It was just one small comment of hers that, apparently, activated the right connections in my brain, got me out of the state of being stuck, made me overthrow the whole theory, rewrite all chapters written so far, invest tons of time, but come out with a product that by far supercedes the original version in quality.

I would also like to thank all those native speakers who lent their linguis-

tic competence and performance to my shameless scrutiny. In addition to dozens of anonymous Russian speakers, I would like to thank particularly Xenia Guiliarova and all her family, Irina Koznova, Gulnara Rakhmatoulina, Zulia Rakhmatoulina, Tania Reznikova, Olga Shmyrina, Julia Trushkina, Konstantin Tsimbaev, and especially Dmitrij Trubčaninov for the longest recording sessions of all. I am also indebted to Shinichiro Ishihara, Elizabeth Medvedovsky, Janina Radó (again), Kepa Joseba Rodríguez, and Özgür Şahin for our discussions of Japanese, English, Hungarian, Basque and Turkish. Talking about languages, I have once again to thank Janina Radó for correcting my English (as a natural language), and Elke Kasimir for checking my formal languages.

Finally, I am endlessly indebted to my mother, Natalia Petrovna Jasinskaja, who took over so much trouble in order to keep me out of it, and let me concentrate on work; as well as the rest of my family for keeping their fingers crossed for such a long time.

In sum, I enjoyed every minute of working on my thesis, and these people made this possible. Thank you all!

Last but not least, the German Research Community (DFG) gets full credit for providing the essentials, in particular, as part of the Graduate College “Integrated Linguistics Studies” (Graduiertenkolleg Integriertes Linguistik-Studium), the Collaborative Research Center “Linguistic Data Structures” at the University of Tübingen (SFB441), and the Collaborative Research Center “Information Structure” at the University of Potsdam (SFB632).

Chapter 1

Introduction

The meaning of a discourse is more than the sum of the meanings of the clauses and sentences it consists of. One and the same clause can be understood in many different ways depending on the context it occurs in, and one of the aspects of this additional content that comes on top of the semantics of the clause as such is its relation to other clauses in the discourse. These relations may be of different kinds and hold at different levels of linguistic representation. For instance, the individuals mentioned in a clause can corefer with individuals mentioned in other clauses. Clauses may describe states of affairs or events which can stand in various sorts of temporal, causal, part-whole and, in particular, coreference relations. The propositions denoted by the clauses may entail or contradict one another, and finally, if a clause forms a speech act, its communicative goal may relate to the communicative goals of other speech acts, giving rise to such relations as thesis and antithesis, justification, motivation, etc. The term *discourse relation* (or otherwise, coherence relation, rhetorical relation) as it is typically used in the pragmatics and discourse semantics literature refers primarily to interclausal relations that hold between “bigger” entities—eventualities, propositions, and speech acts (rather than e.g. individuals). Discourse relations in this sense are the object of this study.

Natural languages provide a stock of expressions whose primary function is to signal discourse relations. Thus, for instance, the subordinating conjunction *because* in (1a) expresses a causal relation between the described events, whereas the anaphoric adverbial *then* in (2a) encodes the relation of temporal succession. However, one of the most fascinating and puzzling facts about discourse interpretation is that such relations can often be successfully established by the hearer without any explicit signals. For example, the causal relation is still conveyed by (1b), although *because* is not there, and (2b) is still understood as a temporal sequence even without *then*. Thus (1b) and (2b) exemplify the phenomenon that we will refer to as *implicit* discourse relations.

- (1) a. Max fell, *because* John pushed him.
b. Max fell. John pushed him.
- (2) a. The lone ranger jumped on the horse and *then* rode into the sunset.
b. The lone ranger jumped on the horse and rode into the sunset.

Implicit discourse relations must be inferred by the hearer, but of course,

not all inferences based on linguistic input belong to the proper domain of linguistics. For instance, one might “infer” from the discourses in (2) that the lone ranger (most probably) has two legs, but is this part of the content conveyed by these discourses? Similar doubts may be raised by many cases of inferred inter-clausal meanings. However, there are at least certain types of discourse relations that have been shown to play an essential role in a whole range of genuinely linguistic processes, including resolution of anaphora and ellipsis, presupposition accommodation, the interpretation of tense and aspect, and resolution of lexical ambiguity, to name just a few (see e.g. Kehler, 2002; Asher and Lascarides, 2003). Modelling the inference of such relations constitutes a necessary step in modelling these phenomena and is therefore of primary concern to linguists. How such relations are inferred, and why, are the main questions that this study is going to address.

There are two major positions in pragmatics on the nature of (implicit) discourse relations. According to one position, most prominently represented by Asher and Lascarides’ (2003) Segmented Discourse Representation Theory (SDRT), a discourse must be *coherent*, and discourse relations constitute the main vehicle of achieving coherence. That is, the process of discourse interpretation and establishing discourse relations as part of it, essentially boils down to finding out in which way the sentences in a discourse belong together. The fundamental role played by discourse relations in this framework is reflected by their status as ontologically primitive notions, and the particular inventory of such primitives is motivated by the needs to account for the linguistic phenomena mentioned above. The other position, which I will generally refer to as the Gricean approach, does not assign such a basic status to discourse relations and does not view establishing discourse coherence as a goal in itself. Rather, the first and foremost requirement that a discourse must meet is fulfilling its communicative goal, i.e. it must be *relevant* in the given communicative situation. Coherence and discourse relations, as well as all other inferences that go beyond the conventional meaning of sentences (the *implicatures*) in turn are viewed as side effects of finding out in which way a discourse is relevant. This approach initiated by the ideas of Grice (1975, 1989) is maintained by his followers in the framework of Relevance Theory (Sperber and Wilson, 1986; Blakemore, 2002) and the Neo-Griceans (e.g. Levinson, 2000), and although there are a lot of differences within the Gricean camp, they all agree in attributing primacy to relevance and communicative goals, and secondary, epiphenomenal status to coherence.

Deriving coherence phenomena from the Gricean principles of rationality and cooperativity in communication is an appealing idea, but its concrete realisations so far have been subject to a lot of criticism on the part of the advocates of the coherence-based approach. For instance, Asher and Lascarides (2003) put forward the following objections. First, unlike SDRT, no Gricean theory is sufficiently formalised to provide a detailed analysis of the relevant linguistic phenomena. Second, traditional approaches to pragmatics are primarily sentential theories—they calculate the implicatures of individual utterances but fail to represent meaningful links between utterances. The third point concerns the fundamental idea of making the inference of discourse relations entirely dependent on ‘private’ features of the speakers’ mental states, such as the underlying intentions, goals, etc. Asher and Lascarides argue that discourse relations can often be inferred without recourse to intentions, using the form and the compo-

sitional semantics of the sentence and its context alone, and whenever they can they should, in order to avoid unnecessary conceptual and computational complexity. Finally, Asher and Lascarides point out cases where apparently it is not only possible but also necessary to use the semantics of the context directly in order to infer the correct discourse relation, rather than going via communicative intentions. Assuming that the inference of the speaker’s intentions is based primarily on domain knowledge, it is presumably hard to establish that the second sentence in (3) is intended as an explanation of the first one, since this kind of relationship between being annoyed and eating soup is not supported by domain knowledge. Nevertheless, the sentences in (3) are most naturally interpreted as connected by a causal relation, and Asher and Lascarides relate this fact to the properties of psychological verbs like *annoy*, which activate the cause of the psychological state in their lexical entry.

(3) Mary is annoyed. Fred ate soup last night.

This study will take up the challenge of making a contribution to the development of a theory of discourse relations which on the one hand meets the critical points presented above, but on the other hand upholds the Gricean idea of the primary status of communicative intentions and relevance. In other words, my ultimate goal is a theory that derives implicit discourse relations like other conversational implicatures from the general principles of rational and cooperative communicative behaviour, and does so in a formally precise way. Ideally, the fact that only limited information about the speaker’s intentions is needed for the inference of discourse relations would follow as a consequence of such a theory, rather than serve as an excuse for not modelling the intentional structure at all. The present study will explore the thesis that formulating such a theory is possible.

Of course, this is a huge project that cannot be carried out in full in this dissertation. Therefore I will concentrate on one rather small fragment of it. Among the linguistic phenomena that are known to interact with discourse relations, I will study in particular the pragmatic effects of the conjunction *and* as opposed to *asyndetic connection*—paratactic juxtaposition of clauses without any connectives. A classical example illustrating the phenomenon in question is given in (4). The asyndetically connected sentences in (4a) are understood as presenting an event and its cause, i.e. Max fell *because* he slipped on a banana peel, whereas the conjoined clauses in (4b) do not have this causal interpretation.

- (4) a. Max fell. He slipped on a banana peel.
b. Max fell *and* he slipped on a banana peel.

The discourse relation exhibited by (4a) is usually called *Explanation*, i.e. the second clause explains the first. Other relations that are affected by the presence of *and* in a similar way include *Elaboration*, *Particularisation*, *Generalisation*, *Reformulation*, which will all be subsumed here under the label of *Restatement*. The present study will concentrate especially on this latter group of discourse relations.

The term “restatement” as applied to discourse relations was introduced by Mann and Thompson (1988, p. 277), and referred originally to a relation that holds between utterances that, roughly, restate the same content in different words, such as (5).

- (5) A well-groomed car reflects its owner.
The car you drive says a lot about you.

The current notion of *Restatement* is much broader, and closer to that used by Blakemore (1997). It applies to cases where two utterances describe the same state of affairs or event, but these descriptions need not be informationally equivalent. For instance, one description may be more detailed or more specific than the other (*Elaboration, Particularisation*); or it may present the eventuality from a different perspective (e.g. *Generalisation*). *Restatement* in the relevant sense is exemplified by (6). Here the information conveyed by the sentences is quite different, but the described eventualities are identical in the sense that they occur at the same time, occupy the same space, and involve the same participants.¹ That is, the skis used to be Alena's main transportation means and she lost it *in that* she broke them.

- (6) Alena broke her skis. She lost her main transportation means.

The impact of *and* on the establishment of this discourse relation becomes evident in (7). Whereas the interpretation of the sentences as describing the same eventuality is perhaps not excluded, a different reading becomes more accessible: Alena broke her skis, and *apart from that* she lost her main transportation means (e.g. her car was stolen).

- (7) Alena broke her skis, *and* (she) lost her main transportation means.

The phenomenon illustrated in (4) and (6)/(7) was studied in some detail by Blakemore and Carston (1999, 2005) in the framework of Relevance Theory and by Txurruka (2003) in the framework of SDRT. Txurruka analyses *and* as a discourse marker that directly blocks the inference of *Explanation* and *Restatement* in the above sense, whereas Blakemore and Carston treat this phenomenon in a rather more indirect way. *And* receives a standard conventional interpretation (logical conjunction), whereas its crucial function that leads to the effect in (4b) and (7) is simply making one sentence/utterance out of two. As a consequence, (4b) and (7) must be relevant as a whole, whereas in (4a) and (6), each of the asyndetically connected sentences must be relevant on its own. The interpretive contrasts between *and*-conjunction and asyndetic connection are derived from this difference. Thus Blakemore and Carston's approach is perfectly in the spirit of the proclaimed research programme as it derives discourse relations associated with the two modes of connection from the way they interact with relevance. However, this approach has not yet received an implementation at a level of formal rigour comparable to e.g. Txurruka's or any other work in the framework of SDRT.

This gap should be (partly) filled by this study. I will propose a formal theory of the impact of *and* vs. asyndetic connection on the inference of *Restatement* based on ideas similar to Blakemore and Carston's. The central role in this analysis will be played by the notion of *exhaustive interpretation*. Roughly speaking, the exhaustive interpretation of a proposition *p* is *p* plus the statement that all other propositions are either irrelevant or false (or the speaker does not know), i.e. *p* is the only/most relevant proposition that holds. I will adopt the formalisation of this notion proposed by van Rooij and Schulz (2004b), which in

¹The identity criteria for eventualities adopted in this study are based on the standard assumptions of event semantics, e.g. Eckardt (1998).

turn is based on the *circumscription* mechanism developed by (McCarthy, 1980, 1986). This formalisation is intended by the authors as an implementation of the Gricean principle: In uttering *p* a rational and cooperative speaker makes a maximally relevant claim given her knowledge.² At the same time, van Rooij and Schulz' theory is closely related to optimality theoretic pragmatics (cf. van Rooij, 2003b)—a general formal approach to pragmatics inspired by the work of Blutner (e.g. 2000), and currently a rapidly developing field. Thus the theory proposed in the present study will be interpretable both in traditional Gricean terms and in terms of formal optimality theory.

However, before approaching the formal matters, one empirical issue will receive special attention—the *prosodic realisation* of discourses like (4) and (6). Prosodic considerations have been almost entirely ignored in previous studies on the pragmatic differences between conjunction *and* and asyndetic connection; however, a careful look at prosody will make us seriously reconsider the traditionally assumed empirical generalisations. In particular, the distinction between rising continuation intonation and falling completion intonation crosscuts the category of asyndetic connection revealing a remarkable pattern. Asyndetically connected utterances ending in a fall exhibit a bias towards *Restatement* and *Explanation* readings, whereas those ending in a rise behave in a way similar to *and*-conjunctions. Separating different cases of asyndetic connection according to the associated intonation patterns will allow us to make stronger generalisations about each particular case, which in turn will motivate a stronger theory. In particular, the analysis in terms of exhaustive interpretation will only apply to sequences of utterances bearing a completion tune, whereas continuation intonation will be treated as a marker of non-exhaustivity. However, it should be made clear right away that the present study is purely theoretical. The relevant generalisations about the influence of intonation on the inference of implicit discourse relations will be based mostly on informal observations and should primarily be regarded as a hypothesis. This hypothesis will not be tested in this study, although I will recapitulate some results of previous empirical research on the prosody of spontaneous speech that present indirect support for it and suggest that it is at least worth pursuing.

Finally, it should be said that this choice of focus within the empirical domain of coherence phenomena is not accidental. In my opinion, the pragmatic effects of *and*-conjunction and asyndetic connection as well as intonation serve as a good starting point for the development of an explanatory Gricean theory of implicit discourse relations, since these expressive devices all have extremely abstract, almost empty semantics. It is thus not too plausible to assume that any of them *signals* discourse relations in a more or less direct way. The connections between the surface form and the inferred relations must be very indirect in these cases, possibly by-passing a whole number of different mechanisms involved in discourse interpretation. Uncovering these connections is therefore likely to shed light on the mechanisms involved, and ultimately, on the questions how and why implicit discourse relations are inferred.

This dissertation consists of seven chapters (including the current one) and two appendices. The next two chapters are essentially devoted to giving more substance and structure to the questions raised above, introducing the relevant

²This formulation of the principle combines Grice's first submaxim of Quantity with the maxims of Quality and Relevance.

notions and empirical assumptions. In particular, Chapter 2 defines the distinction between explicit and implicit discourse relations, provides an introduction to the SDRT inventory of relations and surveys facts discussed in the literature pertaining to the question which relations can remain implicit and which must be signalled explicitly, which relations can be inferred between asyndetically connected and which between conjoined sentences. Finally, the chapter discusses previous formal approaches to the inference of discourse relations, as well as Blakemore and Carston's (1999; 2005) and Txurruka's (2003) theories of the role of the conjunction *and* in this process.

Chapter 3 gives full attention to prosodic matters and is devoted primarily to formulating a hypothesis on how the inference of implicit discourse relations is influenced by the distinction of continuation and completion intonation. The chapter starts with an introduction to an approach to representing the intentional structure of discourse based on the notion of Question under Discussion (QUD) developed, for instance, in the work of Klein and von Steutterheim (1987), van Kuppevelt (1995b), Ginzburg (1996a), Roberts (1996), and Buring (2003). This approach provides a criterion for deciding how closely the intentions of two utterances are related. Among the most closely related utterances that are connected asyndetically, a number of distinct cases will be separated depending on their intonational patterns. In particular, I will hypothesise that asyndetically connected utterances that pertain to the same question under discussion and both end in a completion tune have a strong bias for being interpreted as *Restatements* or *Explanations*. This hypothesis will be illustrated by intuitive examples and supported by results of some previous empirical studies. The chapter also discusses the mapping between the functional notions of continuation and completion and intonational patterns of particular languages, illustrating it with an application to Russian.

Having elucidated the problems, the following three chapters develop a solution, concentrating particularly on the case of *Restatement*. Chapter 4 lays out the preliminaries for a formal account of *Restatement* in terms of exhaustive interpretation. It approaches this task by reducing it to another closely related problem: it will be noticed that canonical sentential restatements (pairs of sentences connected by a *Restatement* relation) exhibit a lot of parallelism with what will be called *nominal restatements*—a construction which in turn bears a certain resemblance to nominal apposition. Since the exhaustification of nominal expressions is at present much better understood than the exhaustification of whole sentences, I will argue for exploiting this parallelism and developing a uniform account, which is first applied to nominal restatements and then extended to the sentential case.

Chapters 5 and 6 present the formal analysis of restatement. Although our ultimate purpose is an account in van Rooij and Schulz' framework since it implements the notion of relevance, which is essential for linking the exhaustification-based approach to restatement to Gricean pragmatics, it will be instructive to look at a simpler formalisation first. Groenendijk and Stokhof's theory of exhaustification is a good choice for this purpose since it is more familiar to the linguistic audience, easier to deal with when it comes to conducting a proof, and is a direct predecessor of van Rooij and Schulz' approach in that it implements a special case of predicate circumscription (whereas van Rooij and Schulz use the general case). The results achieved in Chapter 5 based on Groenendijk and Stokhof's proposal will thus serve as a baseline for evaluating the theory devel-

oped in Chapter 6 using van Rooij and Schulz approach. Although in general van Rooij and Schulz' theory supercedes its predecessors, on certain points I will argue for a modification that represents a more conservative approach to exhaustivity that is closer to Groenendijk and Stokhof's. In both chapters, the current theory of exhaustive interpretation will first be applied to nominal restatements, and then, an extension to the canonical sentential restatements will be discussed. Appendices A and B supplement Chapters 5 and 6, respectively, spelling out the relevant formal definitions and providing proofs to selected statements.

Chapter 7 rounds up the present study by sketching out a general pragmatic framework based on the ideas of Zeevat (1994a, 2005) in which the proposed account of *Restatement* is to be integrated. That framework combines exhaustive interpretation as a formal implementation of Gricean implicature with the QUD-based notion of intentional structure (\approx topic structure), and assigns a central role to the default *Principle of Topic Continuity* (related to the ideas of Givón, 1983). This principle states that in the absence of explicit indications to the contrary (such as overt discourse relation markers or topic markers, conjunction *and*, and continuation intonation), the topic, i.e. the question under discussion addressed by the current utterance is the same as that of the previous utterance, or in other words, by default the relevance conditions do not change. The combination of this principle with exhaustive interpretation is intended to provide an account of the bias for *Restatement* and *Explanation* readings of asyndetically connected utterances bearing a completion intonation. The inference of other discourse relations involves violations of either the Topic Continuity or the Exhaustive Interpretation principles, and hence requires the presence of appropriate markers (including conjunction *and* and continuation intonation) to license the violations. Finally, Chapter 7 summarises and draws conclusions from the presented work, points out open questions and marks directions for further research.

Concerning the question how to read this thesis, the answer is unconsoling: this thesis is designed to be read from beginning to end. The chapters are building up strongly on one another and will hardly make much sense out of context. There are, perhaps, two shortcuts that can be taken. The readers that are only interested in the informal ideas behind the pragmatic analysis of discourse relations, and not so much in their formal implementation, can skip Chapters 5 and 6 (although certain portions of Chapter 7 might then be hard to access). Those who are only interested in the application and development of the formal methodology and/or the formal analysis of restatement may concentrate on Chapters 4–6 and the appendices. In order to compensate for the high degree of interdependence between chapters, I have tried to introduce a fair amount of cross-references that should allow one to start reading at an arbitrary point and trace the relevant matter down the thread. Further pointers are given at the beginning of each chapter.

Chapter 2

Implicit relations in discourse

This chapter is devoted to a survey and discussion of the current state of research on discourse relations. The questions of primary concern are what kind of relations can remain implicit, where hearers have no difficulty recovering the intended meanings, and which relations must be expressed overtly in order to be understood, and *why this is so*. For reasons of space, I will, with a couple of exceptions, confine my attention to proposals cast in terms of a formal model-theoretic approach to discourse semantics, especially Segmented Discourse Representation Theory (SDRT), one of the most prominent frameworks in this category with the broadest coverage of relevant phenomena. I will argue that SDRT appears too flexible and too unrestrictive in a number of cases and fails to provide an adequate explanation for the observed patterns in the distribution of explicit and implicit relations, although the descriptive and formal accuracy of the relevant analyses do not raise questions.

As was indicated in Chapter 1, the central subject of the current thesis is implicit discourse relations between sentences, where there are no linguistic signals of connection whatsoever between those sentences, not even intonational ones, such as a rising tune at the end of the first sentence. However, previous attempts to formalise the semantics of discourse relations have largely ignored the contribution of prosody, therefore all prosodic considerations will also be ignored in the discussion below and left entirely to Chapter 3. That is, the current chapter will present the matter from the perspective of the students of written text.

This chapter begins with a general overview of facts observed in the literature that concern the ability of various discourse relations to remain implicit. In other words, the question is which relations can be inferred either between two juxtaposed, but otherwise unconnected independent sentences, or between sentences conjoined with the connective *and*. As already mentioned in Chapter 1, both modes of connection are generally believed to be more or less semantically empty, i.e. equivalent to the logical conjunction. Thus it is particularly puzzling that a whole range of non-trivial semantic relations can be “conveyed” by such constructions. Even more puzzling is the fact that paratactically juxtaposed sentences and conjunctions co-occur with different sets of relations,

which strongly suggests that different inference mechanisms are at work in the two cases. In other words, there seems to be “more than one way of being implicit,” and this phenomenon will receive special attention in this chapter. I will argue for a number of refinements to the most widely accepted empirical generalisations concerning the function of the presence vs. absence of the connective *and*, emphasising the restrictions associated with its absence.

After this survey of data in Section 2.1, Section 2.2 presents a number of formal approaches to establishing implicit discourse relations proposed in the literature. Next, Section 2.3 deals in some more detail with previous accounts of the contribution of the conjunction *and*. Finally, Section 2.4 addresses the issue why certain relations cannot remain implicit, which has not received appropriate attention in the formal discourse semantics literature. The chapter is concluded with a general discussion in Section 2.5, concentrating particularly on the above mentioned criticisms and refinements.

2.1 Implicit and explicit relations: An overview

Repeating once again the famous truism, the meaning of a discourse is more than a simple conjunction of the meanings of its sentences, since it is enriched by various semantic and pragmatic relations that hold between those sentences. These relations include for instance temporal and causal relations between the eventualities described by the sentences, relations of contrast and parallel, and some others. In this section, such relations will be examined in particular with respect to their ability to remain implicit, i.e. be inferred in the absence of any overt linguistic indicators.

The phenomenon of discourse relations has been extensively studied over the last two decades, leading to elaborate taxonomies and inventories of different size and degrees of abstraction (cf. e.g. Hobbs, 1985; Mann and Thompson, 1988; Kehler, 2002; Asher and Lascarides, 2003).¹ In some theoretical frameworks, e.g. the Segmented Discourse Representation Theory (SDRT, Asher, 1993; Asher and Lascarides, 2003), an inventory of discourse relations constitutes a direct part of the theory. Other discourse theorists, e.g. Blakemore (1987), have argued against introducing a fixed inventory of relations as a necessary theoretical construct. Instead it is proposed that discourse relations are an epiphenomenon and the theory should be able to derive them as a consequence of more general pragmatic processes. However, the *phenomenon* of discourse relations is uncontroversially recognised by all camps.

I will orient myself towards the SDRT inventory of discourse relations, however, in this section I will use it primarily as a descriptive tool—a vocabulary for talking about relations. Thus the discussion will have a purely empirical character and is not intended to bear any implications for the above mentioned controversy. The only assumption that I will make after Asher and Lascarides (2003, p. 170) which might be viewed as theoretically biased, is that a discourse is felicitous only if all its sentences can be connected by some non-trivial relation (distinct from a mere logical conjunction) to form a single connected graph. Since I will mainly concentrate on “discourses” that only consist of two sentences or clauses, I will assume without discussion that there must be some

¹See Bateman and Rondhuis (1997) for a comprehensive overview and comparison.

relation between the two, either explicit or implicit, if the sequence is perceived as felicitous.

In what follows, I will first give a working definition to the opposition of explicit vs. implicit relations (Section 2.1.1). Then the SDRT inventory of discourse relations will be introduced in Section 2.1.2, which is followed by Sections 2.1.3 and 2.1.4 devoted to the survey of facts related to two groups of discourse relations—veridical and non-veridical relations—which behave rather differently with respect to the explicit/implicit dimension.

2.1.1 Terminological considerations

The distinction between an *implicit* and an *explicit* realisation of a discourse relation is illustrated by the following examples, adapted from Lascares and Asher (1993) and Carston (1993):

- (8) a. Max fell, *because* John pushed him.
b. Max fell. John pushed him.
- (9) a. She jumped on the horse and *then* rode into the sunset.
b. She jumped on the horse and rode into the sunset.

Both (8a) and (8b) are most naturally understood so that the second sentence/clause *John pushed him* describes the cause of the event mentioned in the first sentence *Max fell*. In SDRT terminology the relation between the sentences is *Explanation*. However, in (8a) it is expressed by the connective *because*, whereas (8b) seems to lack any overt cues that would point towards a causal relation. Similarly, both in (9a) and (9b) the discourses express a temporal sequence of events: first, ‘she’ jumped on the horse, and after that, ‘she’ rode into the sunset. (The relevant SDRT relation is *Narration*.) However, in (9a), the temporal relation is signalled by the anaphoric adverbial *then*, whereas in (9b) it is not signalled explicitly, but can nevertheless be successfully inferred. Thus (8a) and (9a) make the underlying discourse relation *explicit*, whereas in (8b) and (9b) it remains implicit.

Although the explicit/implicit distinction seems intuitively clear in examples like (8) and (9), it is difficult to provide a general definition. Where this distinction should be drawn has been the subject of quite some controversy as it is usually assigned a fundamental role in linguistic theory delineating the domains of semantics and pragmatics (cf. Grice, 1989; Carston, 1997, 2004). By contrast, the way these terms are to be used in this and the following chapters is not intended to have such fundamental consequences. The purpose of making this distinction in the present work is twofold. On the one hand, it is motivated by the central puzzle of discourse studies: how is it possible that non-trivial relations between sentences can be established in the absence of overt cues. Looking from this perspective, the best way of thinking about the distinction is perhaps this: a discourse relation is realised explicitly if it is rather obvious how the interpreter arrives from the linguistic form of the discourse at the given relation (there is some lexical item or syntactic construction that encodes the relation), whereas the relation is implicit if this is not the case. On the other hand, the explicit/implicit opposition will be used to distinguish and to introduce rough structure into a class of data of interest in the present and a number of previous studies. This class of data is restricted to two types of constructions: parat-

actively juxtaposed independent sentences, as in (8b), and clauses connected by the conjunction *and*, cf. (9b). Thus in practice, the term *implicit discourse relation* will serve as an abbreviation for discourse relations that can be inferred in these constructions without other cues. This notion is rather close to the notion of *implicit connection* (Konnexion) defined by Fabricius-Hansen (2000), except that the latter only applies to paratactic constructions without *and* (and with a number of other minor differences).

Thus I am not even going to attempt to give a general definition for the explicit/implicit distinction. In what follows, I will substantiate the notions outlined above by enumerating certain prototypical cases. Nevertheless, the resulting vagueness and occasional idiosyncrasies in the usage of the terms “explicit” and “implicit” should not turn into a fundamental problem, since the actual empirical domain of the theoretical proposal developed in this thesis will be further refined in the subsequent chapters. At this point, the notions will be used to encompass a much broader domain—a kind of field on which we shall place facts like pieces of a mosaic in order to observe patterns and make generalisations.

To begin with, let’s consider cases where the connection between the linguistic form and the underlying discourse relation is rather obvious, i.e. there is an overt *cue*. These cases mainly involve a lexical item that directly encodes some non-trivial discourse relation (distinct from logical conjunction) between two sentences or clauses. Such items come in a number of different types, which include:

- **Conjunctions:** e.g. coordinating conjunctions *but*, *or*, subordinating conjunctions like *after*, *although*, *because*, *if*, etc.;
- **Sentential anaphoric devices:** e.g. anaphoric adverbials *hence*, *instead*, *otherwise*, *nevertheless*, *then*, *therefore*, *thus*, *so*; PPs with an anaphoric element, e.g. *after that*; expressions like *that’s why*, etc.;
- **Particles with sentential presuppositions:** *again*, *also*, *even*, *too*, etc.²

It is common to all these expressions that they have two semantic arguments to be filled by propositions or eventualities, although the ways in which they evoke those propositions or eventualities from the discourse context may be interpreted differently (see e.g. Webber et al., 2003). For instance, conjunctions are standardly believed to project both of their semantic arguments in the syntax,³ whereas in the case of anaphoric and presuppositional connectives

²One could argue that additive particles such as *also* and *too* are equivalent to the logical conjunction, and hence do not express any non-trivial discourse relation and should be treated on a par with *and*. However, these particles impose stricter constraints on parallelism between the propositions they connect than *and* does (see e.g. Fabricius-Hansen, 2000, p. 334), which can be viewed as an indication that they do encode a discourse relation. Asher and Lascarides (2003) propose that *also* and *too* signal the discourse relation of *Parallel*.

³In case of so called “hanging” conjunctions like *because* in (i), where one of the arguments appears in a separate sentence, the notion of syntax is either extended to include inter-sentential “discourse” syntax (cf. e.g. Polanyi, 1988), or it is claimed that the first argument can be evoked anaphorically, so that conjunctions ultimately receive the same analysis as anaphoric discourse markers (e.g. Asher and Lascarides, 2003).

(i) Max fell. *Because* John pushed him.

only one semantic argument is supplied by the syntax, namely by the clause or phrase they are adjoined to. The connection to the other argument is established via anaphora resolution or presupposition satisfaction in the discourse context. However, these differences are irrelevant to our current concerns. What is important is that whenever two sentences or clauses are connected by one of these lexical items, the discourse relation between them is simply a consequence of the lexical semantics of these items modulo anaphora resolution or presupposition satisfaction, and in this sense it is signalled *explicitly*.

Further, I will extend the notion of explicit realisation of a discourse relation to all cases of sentential anaphora, including those where the anaphoric pronoun *this*, *that* or *it* fills an argument position of a verb or a noun. For instance in (10), *this* refers to the fact expressed by the first sentence, so the second sentence presents an *evaluation* of that fact, due to the lexical semantics of the verb *annoy*.⁴

(10) Sarah pushed Max. This annoyed him.

Finally, I will add all sorts of hypotactic syntactic constructions to the set of possible explicit markers of relations between propositions or eventualities, even if these constructions do not involve an overt lexical operator. For example, the German verb-first conditionals such as (11), as well as constructions involving non-finite clauses, like example (12) from Fabricius-Hansen (2000), belong to this category. Here I will assume that the relation is part of the semantics of the syntactic construction.

(11) *Sollte* der Luftkrieg als bloße Drohkulisse gedacht gewesen sein, *verlöre* er spätestens mit dem einsetzenden Winter und der unausbleiblichen humanitären Katastrophe seine Legitimation. (maz-boden-5701)

(12) Lying on the beach, John smokes cigars.

As far as the *implicit* connection is concerned, this category will generally apply to cases where the relation is not encoded by any of the above mentioned linguistic means. As already noted, in practice I will only consider two cases, namely where the discourse relation obtains either between two juxtaposed independent sentences as in (8b), or between clauses connected by the conjunction *and*, as in (9b). Notice that although *and* is a conjunction, I deliberately did not include it in the list of explicit relation markers presented above. According to the standard view, the literal meaning of *and* is equivalent to the logical conjunction, so the semantic relation expressed by *and* is a trivial one. Asher and Lascarides (2003), for instance, explicitly exclude logical conjunction from their inventory of discourse relations (which I will use as basis), claiming that if the interpreters fail to infer a “better” relation between sentences then the discourse is simply infelicitous.

In sum, the working definition of an implicit discourse relation that will be used throughout this chapter is as follows:

⁴Mann and Thompson (1988) propose that the rhetorical relation of *Evaluation* holds in discourses like (10).

- (13) The discourse relation between sentences or clauses S_1 and S_2 is implicit only if:
- a. S_1 and S_2 are either juxtaposed paratactically ($S_1. S_2.$) or connected by the conjunction *and* (S_1 *and* $S_2.$), i.e. S_1 and S_2 are not connected by any other structural connective or do not form a hypotactic syntactic construction;
 - b. Neither S_1 nor S_2 contains an anaphoric expression referring to the proposition, fact, or eventuality expressed by the other sentence;
 - c. S_2 does not contain a lexical item that introduces a presupposition satisfied by S_1 and whose lexical semantics establishes a relation between the propositions expressed by S_1 and S_2 .

Note that the above definition only excludes explicit anaphoric or presuppositional connections between propositions, facts or eventualities in S_1 and S_2 . By contrast, the presence of individual anaphora, e.g. the pronoun *him* in (8b), does not by itself make the discourse relation explicit. Similarly, existence presuppositions of definite descriptions generally do not count as explicators of discourse relations.

Now let's turn to less clear cases of explicit and implicit relations.

It might appear surprising that the above definition does not include verbal tense and aspect among possible signals of discourse relations. Indeed, tense and aspect are known to play an important role in establishing temporal relations between eventualities, and some theoretical analyses make a hidden temporal anaphoric element part of tense/aspect semantics (Kamp and Rohrer, 1983; Hinrichs, 1986). However, the status of these devices is generally less clear. For instance, Dowty (1986) argued that temporal relations are to a large extent the result of pragmatic reasoning, whereas the contribution of tense and aspect *semantics* is rather limited. Thus I will consider tense and aspect as devices involved in the inference of implicit relations rather than in signalling relations explicitly.⁵

Further, according to the definition in (13), the temporal relation in examples like (14), adapted from Dowty (1986, p. 46), counts as implicit, which might appear counterintuitive, too. Here the temporal order of John's arrival and departure is entailed by the combination of absolute time specifications *10 AM yesterday* and *2 PM today*, but there is no expression or construction that would take the two sentences as semantic arguments and directly encode the relative order of the eventualities. In this sense, the relative order is implicit and must be inferred from the encoded absolute times, although surely, the way this inference goes is rather obvious.

- (14) John arrived at 10 AM yesterday. He departed at 2 PM today.

A similar case is illustrated by (15), discussed in Blakemore and Carston (1999), where the contribution of reasoning is perhaps more evident. Here again, the literal meaning of the sentences plus the world knowledge that "doing A-levels" precedes "doing a BA" entails the reversed temporal order of the events, but this relation is not made explicit by any sort of connective in the sense of (13).

⁵The contribution of tense and aspect to the inference of implicit discourse relations will be discussed in Section 2.2.2 below.

(15) She did her BA in London and she did her A levels in Leeds.

On the other hand, there are also cases which we might be inclined to consider as instances of implicit realisation of a discourse relation, which however count as explicit according to the above definition. This is particularly the case with connectives or syntactic constructions with relatively weak semantics, such as the English connective *when*, or the gerund construction. For instance, three different temporal relations can be inferred between the eventualities presented by the *when*-clause and the main clause in Moens and Steedman's (1988) example (16). Of course, one could model this fact by assuming multiple ambiguity of *when*, however, a more plausible approach is to assign it a relatively abstract literal meaning and construe the three different temporal relations as a result of inference of some sort.

- (16) a. When they built the 39th Street bridge
a local architect drew up the plans.
b. When they built the 39th Street bridge
they used the best materials.
c. When they built the 39th Street bridge
they solved most of their traffic problems.

Similarly, the fact that the gerund construction can both have a relatively weak temporal interpretation as in (12) and a much stronger causal reading as in (17) (Fabricius-Hansen, 2000) suggests that the literal meaning of this construction is probably rather weak, whereas the strengthening observed especially in (17) is essentially an inference of an implicit relation.

(17) Being a businessman, John will fool anyone.

These considerations are, of course, absolutely valid. A more comprehensive survey of implicit relations would have certainly encompassed these cases as well, since many of the inference mechanisms involved in establishing implicit relations between paratactically juxtaposed or conjoined sentences are also at work in this type of constructions. Nevertheless, I will consistently ignore these cases in the following sections (i.e. these cases will be treated as if they were instances of explicit realisation of a discourse relation), and restrict my attention to juxtaposition and conjunction for reasons mentioned earlier.

2.1.2 The SDRT inventory of discourse relations

Before we proceed to facts, a few introductory remarks should be made on the SDRT inventory of discourse relations—the range of meanings whose implicit/explicit realisation options are going to be considered. The particular selection of discourse relations employed in SDRT is motivated by the goal of modelling discourse coherence and the truth conditional effects that emerge in coherent discourses and that go beyond the meanings of individual sentences. The set of phenomena that appear to be affected by discourse relations in the SDRT sense include temporal structure, various sorts of anaphora, ellipsis, presupposition and others. In other words, it is quite clear that the relations proposed by Asher and Lascarides (or at least their truth-conditional effects) indeed constitute part of the message carried by the discourse and are thus relevant to linguistics. I will not recapitulate the related argumentation here (see

Asher and Lascarides, 2003, Chapter 2).

Discourse relations in SDRT belong to the level of logical form and connect propositions associated with clauses, sentences or longer stretches of discourse. Strictly speaking, they connect *occurrences* of propositions and in this sense are intended to model relations between utterances, or speech acts, rather than sentences. However, I will often talk about discourse relations as holding between sentences, where this sloppy usage of the terms is unlikely to lead to confusion.

As relations between speech acts, SDRT discourse relations may connect indicatives, interrogatives, as well as imperatives, both within a monologue or a single dialogue turn and between dialogue turns. However, I will only focus on relations between indicatives in a monologue (or a single turn), which do not involve reference to intentions and beliefs of the dialogue agents. Asher and Lascarides also distinguish a set of “divergent” discourse relations, such as *Correction*, that lead to a revision of certain bits of content of the discourse processed previously. These will also be ignored below. The remaining relations which we will concentrate on are *Narration*, *Result*, *Continuation*, *Parallel*, *Contrast*, *Elaboration*, *Explanation*, *Alternation*, and *Consequence*. These belong to the “classical” repertoire of SDRT discourse relations (Asher and Lascarides, 2003, pp. 459–471), and will be explained in the following sections. Some “non-classical” relations such as *Particularisation*, *Generalisation*, *Evidence*, and *Purpose*, will also be considered.

Finally, before discussing the implicit realisation options for these relations, it is worth mentioning that the explicit/implicit distinction does not play such a central role in SDRT as it does, for instance, in Gricean pragmatics and in Relevance Theory. Although Asher and Lascarides motivate a number of claims using the existence of implicit relations as an argument, the theory treats explicit and implicit relations in a uniform way. The same formal mechanisms are employed in both cases (both implicit and explicit relations have to be *inferred*). However, as the facts presented in the following sections are intended to show, this distinction is useful to make, as it is related to some interesting regularities in the semantics of discourse relations. In particular, there is a correlation between implicitness and *veridicality*.

Veridicality is one of a number of criteria that can be used to classify SDRT discourse relations. By Asher and Lascarides’ (2003, pp. 156–157) definition in (18), a discourse relation R is veridical iff a discourse formed by two segments α and β that are connected by R entails the conjunction of the propositions associated with those segments. In other words, veridical relations are at least as strong as the logical conjunction.

(18) **Veridicality:**

A relation R is veridical iff the following is valid:

$$R(\alpha, \beta) \Rightarrow (K_\alpha \wedge K_\beta)$$

Among the relations mentioned above, all except *Alternation*, *Consequence*, and *Purpose* are veridical; *Alternation* is, for instance, non-veridical because it is equivalent to the logical disjunction, and of course, disjunction does not entail conjunction. Since veridical and non-veridical relations tend to exhibit distinct patterns in terms implicit realisation, these two groups will be discussed separately, veridical relations in Section 2.1.3, non-veridical relations in

2.1.3 Veridical relations

This section recapitulates some observations on implicit discourse relations made in the literature. The central question is, which relations can remain implicit in the sense of the working definition given in the previous section, i.e. which relations can be inferred between two juxtaposed independent sentences or *and*-conjoined clauses in the absence of other cues. Of course, the fact that some relation *can* be realised implicitly does not imply that it must be. So this section is only concerned with the *possibility* of an implicit connection given a certain relational content. The range of “relational contents” to be investigated will in turn be provided by the SDRT vocabulary of discourse relations.

Before I start the survey, a few words should be said on the differences between the two modes of implicit connection—bare juxtaposition of sentences, which I will also refer to as the *asyndetic* connection, on the one hand, and coordination with the natural language conjunction *and*, on the other. As already mentioned, one of the most puzzling facts is the very existence of functional differences between these two modes, since both are generally believed to be semantically equivalent to logical conjunction. Nevertheless, previous studies report numerous examples of discourse relations that can be established between two sentences connected asyndetically but not between conjoined clauses, and *vice versa*. In general, there are three possibilities for any relation that allows for implicit realisation in the first place. Some discourse relations appear to be insensitive to the presence of the conjunction *and*, i.e. they can be inferred regardless of the mode of implicit connection. Other relations may only be compatible with asyndetic connection. The third possibility is a discourse relation that can be established between conjoined clauses, but not between juxtaposed independent sentences. All three cases are attested in the language and will be considered systematically in the given order, starting with the (apparently) simplest case—relations that are insensitive to the presence of the conjunction *and*.

“*And*-insensitive” relations

The general case: SDRT discourse relations that appear to be equally expressible by conjoined and paratactically juxtaposed sentences include: *Narration*, *Result*, *Continuation*, *Parallel*, and *Contrast*. The most famous and widely discussed case is that of *Narration*, a relation that holds between discourse segments where the textual order of the segments corresponds to the temporal order of the reported events. This relation can be explicitly signalled by an anaphoric adverbial such as *then* in (19a), but it can also be inferred between clauses conjoined by *and* (19b) or consecutive independent sentences (19c). In other words, all the discourses in (19) convey the same idea, namely that the lone ranger *first* jumped on his horse and more or less immediately *after that* rode into the sunset.

- (19) a. The lone ranger jumped on his horse *and then* rode into the sunset.
b. The lone ranger jumped on his horse *and* rode into the sunset.
c. The lone ranger jumped on his horse. He rode into the sunset.

The phenomenon illustrated in (19) has been in the focus of linguists' and language philosophers' attention at least since Grice (1975). In response to early descriptions which had often attributed temporal readings to the conjunction *and* itself, Grice argued that the proper semantics of *and* is not stronger than the logical conjunction, whereas the temporal sequence interpretation observed in (19b) is a *conversational implicature*—a consequence of the hearer's assumption that the speaker observes conversational maxims, in particular, the fourth sub-maxim of the maxim of Manner that bids the speaker to *be orderly*, e.g. report the events in their order of occurrence. One of the most obvious arguments against the initial idea that the temporal relation is part of *and*'s semantics is the observation that the same relation holds systematically in sequences without *and*, as in (19c), cf. Grice (1981, p. 186); Carston (1993, p. 33).

A short remark on the content of *Narration*: at least in SDRT, *Narration* involves more than a simple temporal order constraint. First of all, Asher and Lascarides (2003, pp. 162–163) argue that the relationship between the reported eventualities is not just temporal, but also spacial, i.e. “where things are at the end of e_1 is where they are at the beginning of e_2 ,” which is why (20) is not a good *Narration*:

- (20) In 1982 Kim moved from LA to Austin.
 ?? She moved from New York to Austin.

Second, sentences in a narrative must have a *common topic*. That is, if we think of a topic as the common content or ‘summary’ of the logical forms of two sentences, then the more informative this summary is, the better the *Narration*. For instance in (21), the most informative common content of the two sentences is simply that “something happened to something.” This is too general, so *Narration* is hard to infer. To put it differently, the sentences have too little to do with each other, thus the discourse appears incoherent.

- (21) My car broke down.
 ?? Then the sun set.

Interestingly, the adverbial *then*—an explicit marker of *Narration*—does not improve the discourse much, thus the topic constraint must be observed independently.

With this in mind, let's now consider, the relations *Result* and *Continuation*, which can be viewed roughly as the strengthened and the weakened versions of *Narration*, respectively, and like *Narration*, can be communicated implicitly both with or without *and*.

The *Result* relation holds between two sentences if the event reported by the second sentence does not only follow but is also caused by the event in the first sentence, as in the examples in (22) from Carston (1993). The marker *so* in (22a) explicitly indicates a causal link, but it is optional; the same relation is successfully conveyed by (22b) and (22c), where *so*, or even the conjunction *and* is absent.

- (22) a. She fed him poisoned stew *and so* he died.
 b. She fed him poisoned stew *and* he died.
 c. She fed him poisoned stew. He died.

Continuation is in turn the watered down version of *Narration*. It was intro-

duced in order to account for discourses like (23), where the order of presentation does not seem to have any implications for the temporal order of the reported events. Thus *Continuation*, rather than *Narration* holds between (23b), (23c) and (23d).

- (23) Kamp and Rohrer (1983):
- a. L'été de cette année-là vit plusieurs changements dans la vie de nos héros.
 - b. François épousa Adèle,
 - c. Jean partit pour le Brésil
 - d. et Paul s'acheta une maison à la campagne.

Nevertheless, *Continuation* is more than a pure conjunction in modern SDRT. Like *Narration*, it still obeys the topic constraint, i.e. the sentences connected by *Continuation* must pertain to the same topic. For example in (23) the topic is 'some changes happened in someone's life last summer,' whereas in (24), adapted from Asher and Lascarides (2003, p. 461), the topic is 'someone looked somewhere for the lost cat.' As both the French and the English example show, the presence vs. absence of *et* / *and* does not seem to have any effect on the inferred relation.

- (24) a. The teacher asked the students to look for the lost cat.
 b. John looked under the table.
 c. Mary looked in the garden.
- (25) a. The teacher asked the students to look for the lost cat.
 b. John looked under the table
 c. *and* Mary looked in the garden.

Finally, the relations *Parallel* and *Contrast* are also known to allow for both types of implicit realisation. Both relations require a certain degree of structural similarity between the sentences they connect, and apart from that, are defined in terms of semantic similarities and differences between the sentences (Asher and Lascarides, 2003, pp. 168–169, 208–209, 465–466). *Parallel* maximises the similarities: the stronger the common theme of the sentences the better the *Parallel* relation. Thus *Parallel* is similar to *Continuation*. For instance, it also holds between (24b) and (24c) and between (25b) and (25c) above, cf. Asher and Lascarides (2003, p. 461).⁶ Typical overt cues to *Parallel* are particles such as *also* and *too*, which are almost obligatory if the degree of semantic similarity between the sentences is high, cf. (26).

- (26) a. John looked under the table, *and* Mary looked under the table, *too*.
 b. John looked under the table. Mary looked under the table, *too*.

However, with the right intonation the particles can be dispensed with, without losing the *Parallel* interpretation:

- (27) a. JOHN looked under the table *and* MARY looked under the table.
 b. JOHN looked under the table. MARY looked under the table.

The *Contrast* relation in turn maximises the semantic differences between the

⁶SDRT (unlike RST) does not exclude more than one discourse relation holding between the same sentences.

propositions marking the themes of the sentences: the greater the differences the better the *Contrast* relation. The maximal difference is between the propositions p and q such that $p \sim \neg q$, i.e. one proposition negates a default consequence of the other. This definition of *Contrast* unites two varieties: formal contrast, and the “denial of expectation” type contrast. Interestingly, the two types exhibit different properties in terms of explicit/implicit realisation. Formal contrast illustrated in (28) is compatible with both kinds of implicit connection:

- (28) a. John speaks French *but* Bill speaks German.
 b. John speaks French *and* Bill speaks German.
 c. John speaks French. Bill speaks German.

Here the contrast is captured by the distinct arguments of *speak*.

On the other hand, as Asher and Lascarides (2003, pp. 168–169) point out, the denial-of-expectation type of contrast is normally signalled by a connective, such as *but* or *however*:

- (29) a. John loves sport, *but* he hates football.
 b. ?? John loves sport. He hates football.

We will return to the discussion of this case on pp. 29–30 below.

This concludes the list of veridical relations that are usually believed to be insensitive to the presence or absence of the conjunction *and*. All the examples presented above are taken or adapted from other authors, and whereas some of them have rarely been discussed, others keep being cited again and again in the literature. This is especially the case with the relations *Narration* and *Result* and examples like (19) and (22). Posner (1980), Blakemore (1987), Carston (1993), Blakemore and Carston (1999, 2005), Txurruka (2003) and probably many others have assumed that the relation of temporal sequence and the cause-consequence relation can be expressed equally well by a pair of conjoined and paratactically juxtaposed independent sentences. Many theoretical claims have been based on this assumption. However, there seems to be some uneasiness in the data. Every now and then one encounters examples that confuse the picture presented above. We consider some examples of this sort in the next paragraph.

Some confusing data: To begin with, Txurruka (2003, p. 281) points out (referring to Ana Alves) that some English speakers find (30b) somewhat less coherent than (30a). The sentences conjoined with *and* exhibit a *Result* relation, but for some reason, the same relation cannot be expressed as felicitously if the connection is asyndetic.

- (30) a. I drank coffee after lunch *and* I couldn’t sleep the whole night.
 b. ? I drank coffee after lunch. I couldn’t sleep the whole night.

Another interesting group of examples is discussed by Asher and Lascarides (2003, pp. 182–183, 200). For instance, the discourse in (32a) could be a response to the question *What did Kim do today?*, but it does not seem to reveal a narrative progression. It seems that the hearer delays the decision about the discourse relation until more information comes in. Once the cue *then* is encountered, cf. (32b), the discourse relation of *Narration* is established between all the three sentences. However, without this continuation the discourse (32a) is not perfectly felicitous, since a final choice of discourse relation cannot be

made.

(31) What did Kim do today?

- (32) a. ? Kim watched TV. She studied.
b. Kim watched TV. She studied. Then she went out.

Thus in (32a), the implicit realisation of *Narration* is not as felicitous as the explicit one in (32b). However, it seems to me that this observation only concerns the asyndetic connection. If the sentences are connected by the conjunction *and* as in (34) the discourse becomes better. Even though it still presents a mere unordered list of things done by Kim, rather than a temporal sequence of events, the weakness of connection seems better tolerated in this case than in (32a).

(33) What did Kim do today?

(34) Kim watched TV *and* (she) studied.

Finally, the following example discussed by Danlos (1999) might appear far fetched at first glance, but a closer look reveals a similar pattern.

(35) Fred damaged a garment. He stained a shirt.

Danlos suggests that if (35) is understood as a complete discourse, the *only* discourse relation that can be established between these sentences is *Particularisation*—a relation that holds between two sentential descriptions of the same event.⁷ *Particularisation* does not belong to the class of *and*-insensitive relations, and will be discussed in more detail below. What is important at this point is the observation that it is the *only* possible interpretation of (35). Danlos further shows that other relations can be inferred between the given sentences given an appropriate cue phrase, e.g. *next* in (36a) indicating *Narration*, or *also* in (36b) indicating *Parallel*.⁸ Thus it is interesting that the *Narration* and the *Parallel* readings disappear once the cue phrases are removed.

- (36) a. Fred damaged a garment. *Next*, he stained a shirt.
b. Fred damaged a garment. He *also* stained a shirt.

Moreover, it seems to me that the *Narration* or *Parallel* interpretation is also possible if the sentences are connected by the conjunction *and*. For instance, (37) can be understood to mean Fred first damaged some garment and after that he stained some shirt. Thus once again we have a case where *Narration* can be established in the presence of an overt cue (36a) or the conjunction *and* (37), but not with asyndetic connection, cf. (35).

(37) Fred damaged a garment *and* (he) stained a shirt.

⁷Danlos emphasises the importance of the “complete discourse” requirement, since if the discourse is continued with a sentence containing an overt cue such as *also* for *Parallel*, cf. (i), the *Parallel* relation is established between all the three sentences, which produces a case similar to Asher and Lascarides’ (32b).

(i) Fred damaged a garment. He stained a shirt. He *also* tore a tie.

⁸According to my intuitions, the discourses in (36) have a rather odd implication that staining a shirt was not a damage to a garment. Nevertheless the *Narration* and *Parallel* readings are clearly available.

All these examples suggest that the relations *Result*, *Narration* and *Parallel* are not as insensitive to the presence vs. absence of *and* as it is often presented in the literature, and combine somewhat better with *and* than with asyndetic connection. At least this appears to be the case in certain contexts. The contextual factors that seem to play a role are the presence of a continuation as well as the fact that the discourse is used as an answer to a question. Indeed, in Chapter 3 I will argue that both factors are relevant. However, for the time being I will ignore these cases and stick to the mainstream opinion that the discourse relations mentioned above can be realised implicitly both by a pair of clauses connected by a conjunction *and* and by a pair of independent sentences.

Implicit relations with asyndetic connection

The second group of discourse relations to be considered includes relations that, according to the existing studies, can be expressed by a pair of unrelated independent sentences, but not by an *and*-conjunction. This group can be further subdivided into three subgroups. I will call the two major subgroups the *Elaboration family* and the *Explanation family*, after the SDRT relations *Elaboration* and *Explanation* as the most central representatives of their “families.” The status of other relations belonging to the two groups is less clear: different researchers distinguish a different number of relations and give them different names. The third subgroup consists of just one discourse relation—*Background*. All these relations are investigated in more detail below.

The *Elaboration family*: By the SDRT definition, *Elaboration* is a discourse relation that holds between two sentences if the eventuality described by the second sentence is a mereological part of the eventuality described by the first sentence (Asher and Lascarides, 2003, pp. 159–162, 204–207, 461–462).⁹ For instance, following Moens and Steedman (1988), Lascarides and Asher (1993) propose that drawing up plans constitutes a *preparatory phase* and hence *part* of building a bridge. Thus (38) is most naturally understood as presenting an event in the first sentence and its part in the second sentence (i.e. the architect drew the plans for *that*, not some other bridge). Therefore, the second sentence of (38) *elaborates* the first.

(38) The council built the bridge. The architect drew up the plans.

As (38) shows, *Elaboration* can easily remain implicit. (In fact, it is even hard to think of a connector that would be appropriate in (38) and signal *Elaboration* explicitly.) However, it is an acknowledged fact that *Elaboration* is sensitive to the mode of implicit connection: it can be established between two paratactically juxtaposed sentences, but disappears with the insertion of *and*, as in (39), discussed by Blakemore and Carston (1999) and Txurruka (2003). (39a) is similar to (38) in that going to Burger King can be understood as the preparatory phase of having a nice meal. In contrast, (39b) is most readily interpreted as presenting two distinct meals, one that was great and one that was at Burger King. Thus in (39b), the second sentence does not describe a part of

⁹What is meant by “the eventuality described by” a sentence is what is often called the “main eventuality” of a sentence (see Asher and Lascarides, 2003, p. 159), which is the eventuality occupying the event argument of the main verb in the “head” clause of that sentence.

the event introduced in the first sentence, and the relation is not *Elaboration*.¹⁰

- (39) a. I had a great meal last week. I went to Burger King.
b. I had a great meal last week *and* I went to Burger King.

Elaboration in the above definition subsumes a number of special cases that are regarded as separate discourse relations by some researchers. For instance, a special case of a part-whole relation is identity, thus a prominent subclass of *Elaboration* relations are those based on *event coreference* rather than a proper part-whole relation. Event coreference in the relevant sense was investigated by Danlos in a number of studies (e.g. Danlos, 1999; Danlos and Gaiffe, 2004). She distinguishes between two discourse relations based on event coreference: *Particularisation* and *Generalisation*. Roughly, *Particularisation* holds between two sentences if they describe the same eventuality and the second sentence presents some new information about that eventuality. *Generalisation* also requires coreference of the main eventualities, but no new information is conveyed by the second sentence, i.e. sentence 2 is implied by sentence 1.

Let's consider *Particularisation* first, exemplified by (40) and (41) from Danlos (1999). In both discourses, the two sentences represent one and the same of Fred's actions, but the second sentence conveys more specific information on that action. For instance in (40), the second sentence communicates that the damage was a stain and the garment was a shirt.

(40) Fred damaged a garment. He stained a shirt.

(41) Fred took care of a tree. He pruned a cedar.

Particularisation can be signalled overtly by cue phrases, e.g. *more precisely*. However, implicit realisation with asyndetic connection is very common, whereas an *and*-conjunction is inappropriate, as shown by example (42) from Deirdre Wilson, cited in Carston (1993, p. 42). The sentences in (42a) are connected by *Particularisation* since they describe the same event and the second sentence specifies who exactly the great actress was that the speaker met at that party. However, in (42b) where *and* is inserted, the sentences refer to two distinct meetings: the speaker met a great actress, and apart from that, (s)he met Vanessa Redgrave. That is, the discourse relation is *Continuation* or *Narration*, rather than *Particularisation*.

- (42) a. I met a great actress at the party; I met Vanessa Redgrave.
b. I met a great actress at the party *and* I met Vanessa Redgrave.

The other discourse relation involving event coreference is *Generalisation*, sometimes also called (or considered a subtype of) *Restatement* or *Reformulation*, and is commonly signalled by the adverbial *therefore*, or the cue phrase *that is*:¹¹

(43) Fred stained a shirt. *Therefore*, he damaged a garment.

(44) Fred pruned a cedar. *Therefore*, he took care of a tree.

¹⁰The discourse relation in this case could be *Narration* or *Continuation*.

¹¹The examples in (43) and (44) might create the impression that a *Generalisation* is just a mirror image of a *Particularisation*, cf. (40) and (41). However, this is not always the case, see Danlos (1999) for details.

Generalisation appears more restrictive with respect to implicit realisation, which seems to be related to its peculiar status in terms of information flow in discourse. As already mentioned, *Generalisation* holds between two sentences if the first one implies the second. For instance in (44), the fact that Fred took care of a tree follows from the fact that he pruned a cedar, since *cedar* is a hyponym, or subtype of *tree*, and pruning is a subtype of taking care of a tree. A natural question that arises is: what's the point of saying the second sentence if it does not bring any new information? Danlos suggests that *Generalisations* serve to "present an event in a new light, for example, if the speaker has the intention to forge links with other data" (Danlos, 1999).¹² This aspect of *Generalisation/Restatement/Reformulation* was studied in some detail by Blakemore (1993, 1997). Blakemore admits that a reformulation may sometimes be unplanned—a result of the speaker's recognition that (s)he had miscalculated the hearer's contextual and processing resources. For instance if after uttering the first sentence the speaker realises that it used terms unfamiliar to the hearer, such as *anacrusis* in (45), (s)he reformulates it in more familiar terms. However, the speaker may also deliberately produce a reformulation. In this case, the purpose in (45) is not so much to communicate the information about the beginning of the piece, but to introduce the term *anacrusis*. Restating Blakemore's suggestion in somewhat different terms, the new information contributed by the second sentence is the synonymy of the expressions *anacrusis* and *an unaccented note which is not part of the first full bar*, i.e. the new information is the *Reformulation* relation itself.

- (45) At the beginning of this piece there is an example of an anacrusis.
That is, it begins with an unaccented note which is not part of the first full bar.

I think that the restrictions on the implicit realisation and more generally, on the felicity of *Generalisation/Restatement/Reformulation* are largely due to the properties of these relations mentioned above. The more informative the second sentence and the less trivial the knowledge that makes it possible to establish an implication relation between the first and the second sentence, the more felicitous the *Generalisation* discourse and the better the implicit connection. Consider the following series of examples:

- (46) a. # Fred pruned a cedar. *Therefore*, he did it.
b. # Fred pruned a cedar. He did it.
- (47) a. Fred pruned a cedar. *Therefore*, he took care of it.
b. # Fred pruned a cedar. He took care of it.
- (48) a. Fred told Mary that she is pretty. *Therefore*, he complimented her.
b. ? Fred told Mary that she is pretty. He complimented her.
- (49) a. Language is rule governed. *That is*, it follows regular patterns.
b. Language is rule governed. It follows regular patterns.

In (46), the implication relation between the first and the second sentence is as trivial as you can get, all the components of the second sentence *he, did, it*

¹²Therefore, according to Danlos, the relation should be placed at the intentional, rather than the informational level.

simply refer anaphorically to the corresponding components of the first sentence. In this case the whole discourse is infelicitous, and even an overt marker of *Generalisation* in (46a) does not make it better. In (47) we observe a contrast between the explicit and the implicit realisation. Here, the implication relation is established partly via resolving anaphoric links (*he/Fred, it/a cedar*), and partly via accessing a hyponymy/hyperonymy relation specified in the lexicon (*prune/take care of*). This is somewhat less trivial than the previous case, but still too trivial for the intended relation to remain implicit (at least in the absence of further context). Apparently, the speaker has to justify uttering a sentence that contains no new information and emphasise the relation as the new part by marking the relation explicitly. The discourses in (48) in turn are altogether more natural than those in (47). Danlos (1999) points out that *Generalisation* relations based on “extended hyperonymy” (hyperonymy that involves cultural or encyclopedic knowledge) generally give rise to more natural discourses than purely lexical hyperonymy.¹³ Finally, the implication relation between the sentences in (49) can only be established by accessing highly specific domain-related knowledge, so the discourse can even be used to communicate that knowledge as a kind of implicature, i.e. the speaker can utter (49) in order to convey what (s)he takes “rule governed” to mean. Obviously, such a non-trivial reformulation does not require any additional “justification” and can be phrased both with and without an overt marker.¹⁴

In sum, the implicit realisation of the *Generalisation/Restatement* relation undergoes stronger constraints than that of *Particularisation*, however, these constraints appear to be closely related to the informational contribution of the second sentence. If we factor out the impact of informativity, *Generalisation/Restatement* behaves like *Particularisation* and other varieties of *Elaboration* in that it combines with asyndetic connection better than with an *and* conjunction. As already mentioned above, (49b), repeated in (50a) can be understood to introduce the term “rule-governed” via reformulation. However, this implicature disappears in (50b), where the sentences are connected by *and*. Thus (50a) is a *Restatement* whereas (50b) is not (Blakemore and Carston, 1999; Txurruka, 2003).

- (50) a. Language is rule-governed. It follows regular patterns.
 b. Language is rule-governed *and* it follows regular patterns.

Finally, we should mention the discourse relation *Instance*, or *Exemplification*, which is sometimes viewed as another special case of *Elaboration*, but sometimes distinguished from it as a separate relation. *Exemplification* holds between an abstract statement and an example illustrating that statement. The most typical cue phrases are *for example* and *for instance*, whereas the implicit realisation follows the same pattern as with the other representatives of the *Elaboration* family discussed above: the asyndetic connection is appropriate, whereas the *and* conjunction is not. Thus in (51a) and (51b) the second sentence presents an example for the statement in the first, whereas in (51c) the *Exemplification* relation cannot be established, and the border skirmishes between Champaign and Urbana are not understood as an instance of war (Blakemore

¹³The same is claimed for *Particularisation* discourses (Danlos, 1999).

¹⁴The examples (46b), (47b), (48a) and the corresponding judgements are taken directly from Danlos (1999), and (49b) from Blakemore and Carston (1999). The rest is supplied by myself.

and Carston, 1999; Txurruka, 2003).

- (51) a. Wars are breaking out all over.
 For example, Champaign and Urbana have begun having border skirmishes.
 b. Wars are breaking out all over.
 Champaign and Urbana have begun having border skirmishes.
 c. Wars are breaking out all over
 and Champaign and Urbana have begun having border skirmishes.

To summarise, *Elaboration* and a number of discourse relations associated with it exhibit the same pattern regarding implicit realisation. They can be established between juxtaposed independent sentences, but not between sentences connected by the conjunction *and*. Next, let's investigate the other major group of discourse relations that shows the same behaviour—the *Explanation* family.

The *Explanation* family: The discourse relation *Explanation* is standardly defined as connecting sentences where the second sentence presents the cause of the eventuality introduced in the first sentence (Asher and Lascarides, 2003, pp. 159–162, 204–207, 462). Since causes always precede in time, or at least do not follow their consequences, the temporal order of the reported events in an *Explanation* discourse is *reversed* with respect to their textual order.¹⁵ The classic example of *Explanation* was given in (8) in Section 2.1.1 and is repeated in (52a) and (52b) below. The relation can be signalled explicitly by the connective *because* (52a), but it can also be inferred between two paratactically juxtaposed sentences in the absence of overt cues (52b); however, the use of *and* precludes the inference of *Explanation*. Thus in (52c) where the sentences are connected by *and*, John pushing Max is not understood as the cause of Max' falling as in (52a) and (52b); instead, the discourse is interpreted as a temporal sequence of events: Max fell *and then* John pushed him, i.e. the inferred relation is *Narration* (Asher and Vieu, 2005, p. 599).

- (52) a. Max fell, *because* John pushed him.
 b. Max fell. John pushed him.
 c. Max fell, *and* John pushed him.

The causal relationship between eventualities that gives rise to an *Explanation* relation between sentences can be of a various degree of directness. For instance according to Danlos (2001), *direct causation* takes place if the cause is an action performed by a (human) agent and the result is a physical change of state of an object. These requirements are fulfilled in (52) since pushing is an action performed by the human agent John which causes Max' falling, i.e. a physical change in his state. A further example of an *relExplanation* discourse based on direct causation is given in (53).

- (53) Fred cracked the carafe. He hit it against the sink.

The direct causation relation in discourses like (53) is sometimes analysed in terms of event coreference.¹⁶ For instance, Danlos (2001) proposed that

¹⁵In this respect *Explanation* is dual to *Result* where causes precede their effects both temporally and textually.

¹⁶Cf. the discussion of *Particularisation* and *Generalisation* relations in the previous sub-

causative verbs such as *crack* introduce two event variables into the DRS, one for the action performed by the agent and one for the resulting “cracked” state of the object, whereas the causal relation between the action and the state is specified directly in the lexical entry of the causative verb (see also Kamp and Roßdeutscher, 1994a). Establishing an *Explanation* relation then involves establishing coreference between the action supplied by the causative verb, and the event specified in the second sentence, e.g. John’s hitting the carafe against the sink in (53).¹⁷ The involvement of event coreference led other researchers, e.g. Behrens and Fabricius-Hansen (2002, pp. 47–48), to classify discourses like (53) as *Elaborations*. But whatever the classification, the pattern of implicit realisation is the same: the insertion of *and* excludes the *Explanation/Elaboration* reading.

In contrast, relations like the one between the eventualities in (54) are not strictly causal since they are mediated by a mental act or state of the agent. Such relations may or may not be included under the label of *Explanation*. (E.g. Danlos (2001) labels the relation in (54) as *Motivation*.) But again, the details of classification do not matter to the implicit realisation pattern. For instance in (55) from Txurruka (2003, p. 262) where the causal relationship is even more questionable than in (54), the conjunction *and* takes the familiar effect: an explanation-like relation can be established in the asyndetic version (55a), but not in the conjoined version (55b).

(54) Fred broke the carafe. He was angry with Mary.

- (55) a. John and Mary baptized all their children.
 They are good catholics.
 b. John and Mary baptized all their children
 and they are good catholics.

Finally one should mention the discourse relation of *Evidence* that is similar to *Explanation* in many respects although it does not involve causality in the same sense. Like *Explanation*, *Evidence* can be signalled by the connective *because*, as in (56), but the *Explanation* and the *Evidence* readings of sentences with *because* are clearly distinct. On the *Explanation* reading, the fact that Tom’s wife is not here is understood as the reason of Tom’s departure; on the *Evidence* reading, it provides evidence for the belief that Tom has left, cf. Blakemore (1987, pp. 78–79). More formally, Asher and Lascarides (2003, p. 162) characterise *Evidence* as a relation that holds only if the conditional probability of the proposition expressed by the first sentence/clause being true given that the second sentence is true is strictly greater than the unconditional probability of the proposition expressed by the first sentence.

(56) Tom has left *because* his wife isn’t here.

To complete the picture, consider (57) that illustrates the implicit realisation of the *Evidence* relation. Once again, the pattern is the same as for *Explanation*. *Evidence* is compatible with asyndetic connection (57a), but the insertion of *and* changes the interpretation of the discourse: in (57b) Tom’s departure and his wife’s absence are perceived as two independent facts (*Parallel*) or as a cause-

section.

¹⁷The analysis of *Explanation/Elaboration* in terms of event coreference will be discussed in more detail in Chapter 7.

consequence pair (*Result*), but we do not attribute to the speaker the intention to justify by the second sentence the claim made in the first.

- (57) a. Tom has left. His wife isn't here.
b. Tom has left *and* his wife isn't here.

Background: The last discourse relation that, according to Txurruka (2003, p. 276–277), can be expressed by a pair of juxtaposed independent sentences but not by an *and*-conjunction is *Background*. This relation holds between two sentences when one sentence presents the surrounding state of affairs in which the eventuality mentioned in the other sentence occurred. In consequence, the ‘background state’ and the ‘foreground eventuality’ overlap in time (Asher and Lascarides, 2003, p. 460). A typical example of *Background* is given in (58a): the first sentence specifies the foreground event, whereas the background state is the director being slumped in her chair; the event occurs at some point within the duration of the state.

- (58) a. He walked into the room. The director was slumped in her chair.
b. He walked into the room *and* the director was slumped in her chair.

Txurruka suggests that (58b) contrasts with (58a) in a subtle way. The insertion of *and* coerces the state mentioned in the second clause into an event of perception of that state, i.e. roughly, (58b) is interpreted as: He walked into the room and *saw that* the director was slumped in her chair. The relation between the walking into the room and the seeing event is that of temporal sequence, thus Txurruka argues that the relation in (58b) is *Narration* rather than *Background*. Notice however, that the insertion of *and* does not seem to take any effect on the relation between the walking into the room event and the director being slumped in her chair state itself. Both in (58a) and (58b), the time of the event is included in the time interval covered by the state.

Remarks: The discourse relations that combine well with paratactic juxtaposition and do not tolerate *and*-conjunction seem to form a rather clear-cut class. However, the issue of “incompatibility” of these relations with *and* deserves a couple of further remarks. As we have seen, many of these relations have a “semantic,” content-level component; that is, once the discourse relation is established between two sentences, the contribution of the relation to the interpretation of the resulting discourse may contain information about how things are in the world: varieties of *Elaboration* entail coreference or part-whole relations between described events, *Background* involves temporal and *Explanation* both temporal and causal relations. It should be noticed that the insertion of *and* does not always preclude the inference of this semantic content.

The most widely discussed case is the temporal consequences of *Explanation*. Recall that if sentence 2 is an *Explanation* of sentence 1 then the main eventuality of sentence 2 must precede or overlap in time with the main eventuality of sentence 1. A number of researchers have argued against the idea that *and* is incompatible with “temporal reversal,” i.e. the case where the event expressed by the second conjoined clause precedes the event expressed by the first clause (Carston, 1993; Blakemore and Carston, 1999; Txurruka, 2003), as illustrated in (59)–(61). In all three examples, the clauses connected by *and* are understood

as reporting the events in the reversed order.¹⁸

- (59) BILL went to bed | *and* HE took off HIS shoes |
- (60) A: Bob wants to get rid of these mats. He says he trips over them all the time. Still, I don't suppose he'll break his neck.
 B: Well, I don't know.
 JOHN | broke his LEG |
and HE | tripped on a PERSIAN RUG |
- (61) A: Did John break the vase?
 B: Well | the VASE BROKE |
and HE dropped it |

Moreover, (60) and (61), as well as (62) clearly show that *and* does not exclude a backwards causal relation either. In the case of (60B) and (61B), the speaker might not be asserting that the event mentioned in the second clause caused the event mentioned in the first, but neither do the discourses say that the second event did not cause the first. Example (62) due to Caroline Heycock (cf. Asher and Vieu, 2005, p. 599) is particularly interesting, since despite the presence of *and*, the causal relation between the pushing and the falling event and the *Explanation* relation between the sentences seems to be the best accessible, if not the only possible interpretation. Thus (62) can even be viewed as a counterexample to the overall pattern.

- (62) John fell, *and* it was Chris who pushed him.

Discourse relations around *Elaboration* received less attention from this perspective, but as far as I can see, they behave similarly: conjunction *and* can generally coexist with the semantic relations between events (identity, part-whole relations) associated with *Elaboration*. Consider, for instance, the Russian discourses in (63), as well as their English translations in (64).

- (63) a. Alena varila malinovoe varen'e
 Alena cook.IMPERF.PAST raspberry jam
i tem samym vpolnjala Marinino zadanie.
 and by that fulfill.IMPERF.PAST Marina's assignment
- b. Alena varila malinovoe varen'e
 Alena cook.IMPERF.PAST raspberry jam
i vpolnjala Marinino zadanie.
 and fulfill.IMPERF.PAST Marina's assignment
- (64) a. Alena was cooking raspberry jam
and in doing so (she was) fulfilling Marina's assignment.
 b. Alena was cooking raspberry jam
and fulfilling Marina's assignment.

Despite the presence of the conjunction *i/and*, the (a)-versions of (63) and (64) are most naturally interpreted as *Particularisation*, the first and the second conjoined clause describe the same activity (i.e. Marina's assignment for

¹⁸Obviously, this interpretation is supported by the intonation pattern that involves contrastive stress. Small caps indicate the placement of contrastive stress, whereas vertical bars indicate prosodic phrasing.

Alena was to cook raspberry jam). The identity of the cooking and the fulfilling activities is signalled explicitly by the expression *tem samym/in doing so* here. The (b)-versions of (63) and (64) differ from the (a)-versions in that this expression is removed. These discourses acquire an additional reading where cooking and fulfilling the assignment are understood as distinct activities, i.e. Alena was cooking jam and at the same time she was fulfilling Marina’s assignment in doing something else, e.g. listening to the broadcast news (the discourse relation is *Continuation*). However, the event coreference reading—the reading shared with (63a) and (64a)—does not disappear, so (63b) and (64b) are ambiguous. These examples show that event coreference—a content-level consequence that accompanies *Particularisation*—can also be established in an *and*-conjunction even in the absence of overt cues.

Of course, it remains to be clarified which factors determine whether *and* has a content-level effect excluding a particular semantic relation between events, as in (52b) vs. (52c), or does not as in the above examples. However, it is quite clear that *and* is not altogether incompatible with backwards causal and identity relations between eventualities that constitute the semantic consequences of *Explanation* and *Elaboration*. As far as *Background* is concerned, (58) demonstrated that the insertion of *and* does not affect the temporal consequences of *Background*. As we shall see in Section 2.3, these observations complicate the theoretical analyses of conjunction.

Implicit relations in *and*-conjunctions

The last type of pattern that we find in veridical discourse relations is the case where a relation can be communicated by a pair of clauses conjoined by *and*, but not by sentences connected asyndetically. Judging by the picture that we gain from the existing literature, this group contains only one discourse relation—concession, or the “denial of expectation” type of *Contrast* (cf. the remarks on *Contrast* on pp. 18–19). As mentioned earlier, this relation is typically signalled by such connectives as *but*, *however*, *although*, and holds between two propositions (*p* and *q*) if one denies the default consequence of the other, i.e. if *p* then normally not *q*. As Blakemore and Carston’s (2005, p. 580) examples (65a) and (65b) show,¹⁹ sentences connected either by *but* or by *and* successfully convey a denial of expectation relation. Indeed, both (65a) and (65b) convey the idea that if her husband is in hospital then she should be staying at his bed, but she isn’t.²⁰ However, Asher and Lascarides (2003, pp. 168–169) note that denial of expectation cannot be expressed without a connective. If we remove *and* from (65b) the interpretation changes dramatically: in (65c) the relation between the sentences is not of concessive nature; the fact that she is seeing other men is more readily understood as *Evidence* for the claim that her husband is in hospital, i.e. I think that her husband is in hospital because I know that she is seeing other men. (But other non-concessive interpretations are also possible.)

¹⁹The examples are adapted from Kitis (2000).

²⁰On differences between *but* and the adversative use of *and* see Kitis (2000), as well as Blakemore and Carston (1999, 2005).

- (65) a. Her husband is in hospital *but* she is seeing other men.
 b. Her husband is in hospital *and* she is seeing other men.
 c. Her husband is in hospital. She is seeing other men.

This concludes the survey of veridical discourse relations and their implicit realisation options. Next we turn to non-veridical relations.

2.1.4 Non-veridical relations

Non-veridical relations are weaker than the logical conjunction. In SDRT terms, if relation R is non-veridical and it holds between discourse constituents α and β then $R(\alpha, \beta)$ does not entail $K_\alpha \wedge K_\beta$, where K_α and K_β are the SDRS's representing the discourse constituents. Among the standard monological SDRT relations between declaratives, basically two relations belong to this class—*Alternation* and *Consequence*, which correspond to logical disjunction and implication, respectively. In addition, in this section I will consider a *Purpose* relation, which I take to have roughly the same semantics as the English connective *in order to* or the German *damit*. As was pointed out, for instance, by Fabricius-Hansen (2000, 2004), all these relations generally resist implicit realisation with asyndetic connection, although under certain conditions the *Consequence* relation allows for exceptions. It seems, however, that even the insertion of conjunction *and* does not change anything in most cases. In other words, non-veridical relations generally resist both modes of implicit realisation. The examples below show this for each relation.

Alternation: As already noted, *Alternation* is an SDRT discourse relation equivalent to the logical disjunction, i.e. $Alternation(\alpha, \beta)$ entails $K_\alpha \vee K_\beta$. It is clearly non-veridical since $K_\alpha \vee K_\beta$ does not entail $K_\alpha \wedge K_\beta$. The standard marker of *Alternation* is the conjunction *or* in English, *oder* in German, etc. The German example (66a) from Fabricius-Hansen (2004) illustrates this. If the discourse in (66a) is true either of the sentences may be false. In contrast, this interpretation is absolutely excluded for discourses in (66b) and (66c) where *oder* is replaced by *und* ('and') or the asyndetic connection. Neither (66b) nor (66c) can be interpreted as a disjunction, since both discourses entail both of their constituent sentences.

- (66) a. Fritz muss gestern verreist gewesen sein.
 Oder er hat den Termin einfach vergessen.
 b. Fritz muss gestern verreist gewesen sein.
 Und er hat den Termin einfach vergessen.
 c. Fritz muss gestern verreist gewesen sein.
 Er hat den Termin einfach vergessen.

Thus *Alternation* cannot remain implicit.²¹

²¹David Schlangen (p.c.) suggested an interesting apparent counterexample, where *und* or the asyndetic connection can be interpreted as *oder* (in case of the asyndetic connection, an appropriate intonation and gesture might be required):

- (i) A: Was für Alternativen haben wir?
 B: d. Fritz ist gestern verreist, *und* er hat den Termin einfach vergessen.
 e. Fritz ist gestern verreist (\nearrow), er hat den Termin einfach vergessen.

Consequence: The *Consequence* relation in the SDRT vocabulary corresponds to the logical implication where the consequent linearly follows the antecedent (i.e. roughly if α then β , rather than β if α). It is clearly non-veridical since neither K_α nor K_β follows from $K_\alpha \rightarrow K_\beta$, and in natural language it is usually signalled by a connective, such as *if (then)* in English, cf. (67a). But if we use the connective *and* instead (67b) or the asyndetic connection (67c), the discourse is not interpreted as a conditional anymore. Although both in (67b) and (67c) John’s failure to sleep mentioned in the second sentence is interpreted as a “consequence” of his drinking coffee in the first sentence, this is not the *Consequence* relation in the technical sense of SDRT, but the *Result* relation, which is veridical. Indeed, it follows from (67b) and (67c) both that John drank coffee after lunch and that he could not sleep the whole night; whereas (67a) can be uttered if the speaker does not know if John drank coffee or whether he could sleep.

- (67) a. *If* John drank coffee after lunch, he couldn’t sleep the whole night.
 b. John drank coffee after lunch *and* he couldn’t sleep the whole night.
 c. John drank coffee after lunch. He couldn’t sleep the whole night.

Examples like (67) suggest that *Consequence* cannot be realised implicitly, just like *Alternation*. However, the situation with *Consequence* is rather more complex. Whether it can be inferred between two sentences connected asyndetically or by *and* depends on (a) the intonation and (b) the mood/tense of the connected clauses. For instance, Txurruka (2003, p. 281) observes that if the main verbs are in the present rather than the past tense and express a habitual action as in (68), the conditional interpretation is possible in an *and*-conjunction, but not in a pair of juxtaposed sentences without *and*, i.e. (68b) can be truly stated even if the speaker does not actually drink coffee after lunch, whereas (68a) cannot.

- (68) a. ?? I drink coffee after lunch. I can’t sleep the whole night.
 b. I drink coffee after lunch and I can’t sleep the whole night.

However, it appears that the conjunction *and* itself plays a subordinate role here, and the primary role is played by intonation. If the first clause is uttered with a rising “comma” intonation, indicated by “(↗)” in (69a) and (69b), the discourse can receive a conditional meaning regardless of the presence or absence of *and*. If the intonation on the first clause/sentence is falling as in (69c) and (69d), the conditional reading disappears.

- (69) a. I drink coffee after lunch (↗) *and* I can’t sleep the whole night (↘) .
 b. I drink coffee after lunch (↗) , I can’t sleep the whole night (↘) .
 c. I drink coffee after lunch (↘) . *And* I can’t sleep the whole night (↘) .
 d. I drink coffee after lunch (↘) . I can’t sleep the whole night (↘) .

Thus Txurruka’s observation does not place the *Consequence* relation into the same class with concession, or the ‘denial of expectation’ type of *Contrast*, discussed in the previous section. Moreover, whatever the correct generalisation,

However, here the information on the relation is contained in the question *Which alternatives do we have?*, thus the material explicating the relation is elided from the answer. It should be noticed, however, that practically any semantic relation can be made “implicit” by means of ellipsis, so examples of this type do not constitute counter-evidence to the current generalisations on implicit connection.

it applies only to cases where the clauses are in some sense “non-factual,” i.e. their main verbs have the (habitual) present or future tense, subjunctive mood, or the like, which could contribute to an independent explanation of the non-veridical effects in *and*-conjunctions or asyndetically connected clauses with a rising intonation on the first clause. If we factor out these cases, it remains valid that the *Consequence* relation, like other non-veridical relations, generally must be signalled by an appropriate overt connective and cannot remain implicit.

Purpose: The last relation I would like to consider is *Purpose*, which I take to be semantically equivalent to the English *in order to* (+ infinitive) or the German connective *damit*. As already mentioned, *Purpose* does not belong to the standard vocabulary of SDRT discourse relations in Asher and Lascarides (2003), but it is non-veridical and, interestingly, it also behaves like a non-veridical relation in terms of the requirement of explicit marking. For instance, (70a), from Fabricius-Hansen (2004), where the clauses are connected with explicit *damit*, does not entail the content of the second clause, that she will not miss the train. By contrast, the conjoined version (70b) and the paratactically juxtaposed version (70c) both have this entailment. In other words, *Purpose* cannot be inferred if it is not explicitly signalled by an appropriate connective.

- (70) a. Sie beeilt sich, *damit* sie den Zug nicht verpasst.
b. Sie beeilt sich, *und* sie verpasst den Zug nicht.
c. Sie beeilt sich. Sie verpasst den Zug nicht.

To conclude this section, non-veridical relations generally cannot remain implicit, whereas the exceptions observed in the case of *Consequence* occur under clearly identifiable conditions, which suggests treating them as a special case.

2.1.5 Summary

By way of summary, consider Table 2.1 that visualises the generalisations regarding the implicit realisation options of SDRT discourse relations discussed in the previous two sections. This table only reflects the mainstream view presented in the literature, and ignores some exceptions that have been mentioned. In Chapter 3, we will return to some of these exceptions to show that they can be integrated in the overall picture once prosody and a number of additional contextual parameters are taken into account.

2.1.6 Cross-linguistic issues

Finally, before we close the discussion of the empirical issues, a few words should be said on the cross-linguistic validity of the observations surveyed in the previous sections and in Table 2.1. Clearly, most studies on discourse relations are based on English data, therefore most of the illustrating examples in Sections 2.1.3 and 2.1.4 are from English. At the same time, every now and then I used French and German examples to illustrate the same generalisations, as if findings in these languages generalise to English and *vice versa*. For reasons of space it is impossible to discuss this issue systematically here, so I will confine myself to two remarks.

	Asyndetic connection	Conjunction <i>and</i>
Narration	✓	✓
Result	✓	✓
Continuation	✓	✓
Parallel	✓	✓
Contrast (formal)	✓	✓
Elaboration & Co	✓	*
Explanation & Co	✓	*
Background	✓	*
Contrast (concession)	*	✓
Consequence	*	*/✓
Alternation	*	*
Purpose	*	*

Table 2.1: Implicit realisation patterns of SDRT discourse relations. Legend: ✓ / * indicates that the given discourse relation can / cannot be inferred with the given mode of implicit connection.

The first remark concerns the functioning of ‘conjunction’ across languages, i.e. the counterparts of English *and*. Although it is often assumed that conjunction is a universal phenomenon (see e.g. Schmerling, 1975, p. 212), it should be emphasised that connectives such as *and* are first of all lexical items and are therefore part of the lexicon of a particular language. Since the lexicon is generally subject to strong cross-linguistic variation, it is also natural to expect variation in the domain of connectives. In particular this means that English *and* might not have an exact equivalent in each language. The function of English *and* may, for instance, be divided between a number of different connectives in some language *X*, and as a consequence, the set of discourse relations that can be inferred in the presence of those connectives may differ from the list established for *and*, cf. Table 2.1. In fact, Russian instantiates such a language. The semantic field of logical conjunction is covered in Russian by two connectives *i* and *a* which are both usually translated into English as *and*. Simplifying rather crudely, *i* tends to occur with such discourse relations as *Narration* and *Result*, whereas *a* is often more appropriate with *Contrast*, and both connectives can express *Parallel/Continuation* (Sannikov, 1989, 1990; Mendoza, 1996; Kalkova and Podlesskaya, 2001).²² Of course, even this more specific conventional mean-

²²The functional opposition between the Russian conjunctions *i* and *a* depends very much on the syntactic structure as well as the aspectual properties of the conjuncts. Let’s first consider the case where the conjuncts denote states or activities (in the sense of Vendler, 1967). Then, if the conjuncts are VPs, then *i* indicates simultaneity, whereas *a* introduces an additional concessive meaning. For instance, (i) suggests that Marina was taking a bath and at the same time talking on the phone, i.e. the SDRT discourse relation is *Parallel*. By contrast, (ii), where *i* is replaced by *a*, is altogether less felicitous, but if it is to be interpreted at all, then in addition to the temporal overlap it conveys a contradiction between the activities: generally, you should not talk on the phone while you are taking a bath. In other words, this looks like the ‘denial of expectation’ type of *Contrast* and is very similar to the contrastive uses of English *and* studied by Kitis (2000).

- (i) Marina prinimala vannu i razgovarivala po telefonu
 Marina take=IMPERF bath and₁ talk=IMPERF over phone
Marina was taking a bath and talking on the phone.

ing leaves enough space for pragmatic inference; however, one is more reluctant to say that either of the Russian *and*'s is equivalent to the logical conjunction. Further evidence for cross-linguistic variation in the domain of conjunction is given by Ramm and Fabricius-Hansen (2005), who find that Norwegian *og* has a wider usage than English *and* and German *und*.

The second remark concerns asyndetic connection. Unlike conjunction, the absence of a conjunction is not a lexical item. In any case, it would be very undesirable to analyse the asyndetic connection of full independent sentences as a “null” lexical item or even as a grammatical construction. Whatever the effect of asyndetic connection on the choice of discourse relation, this effect must be due solely to general pragmatic processes. Therefore finding considerable cross-linguistic variation here would be much more surprising and compelling, than in the case of *and*. I am not in a position of making empirical statements of such generality, but I believe that the range of discourse relations that can be inferred between juxtaposed full sentences without a connective is indeed more stable across languages. The relevant facts have been established at least for some other Germanic languages. E.g. Fabricius-Hansen (2000) studies English, German and Norwegian discourses and comes up with the following generalisation:

Zwischen parataktisch aneinandergereihten Sätzen ohne Konnektoren

- (ii) ?? Marina prinimala vannu a razgovarivala po telefonu
 Marina take=IMPERF bath and₂ talk=IMPERF over phone
Marina was taking a bath but talking on the phone.

In case the conjuncts are full clauses (with non-coreferential subjects) as in (iii) and (iv), the functional distinction between *i* and *a* turns out to be rather different. Again, both discourses present a pair of simultaneous activities, but now *a* (iv) is “unmarked,” i.e. indicates just temporal overlap, or *Parallel*, whereas *i* (iii) suggests a strong causal or implicational connection between Marina's taking a bath and Alena's talking on the phone: Marina is taking a bath, *therefore* Alena uses the opportunity to phone. Thus the discourse relation is *Result*.

- (iii) Marina prinimala vannu i Alena razgovarivala po telefonu
 Marina take=IMPERF bath and₁ Alena talk=IMPERF over phone
Marina was taking a bath so Alena was talking on the phone.
- (iv) Marina prinimala vannu a Alena razgovarivala po telefonu
 Marina take=IMPERF bath and₂ Alena talk=IMPERF over phone
Marina was taking a bath and Alena was talking on the phone.

Regarding the case where the conjuncts indicate “punctual” events, i.e. achievements or accomplishments, and are realised in the perfective aspect: if the conjuncts are VPs, then the effect of *i* vs. *a* is roughly the same as with activities, illustrated in (i) and (ii) above, except that the underlying temporal relation is succession rather than simultaneity, i.e. the discourse relation in the case of *i* is *Narration*. However, if the connectives conjoin full clauses with distinct subjects, as in (v) and (vi), then *i* indicates a temporal succession, as well as a causal connection (*Result*), cf. (v), whereas *a* does not introduce any temporal constraints (despite the perfective aspect of the conjuncts), i.e. (vi) presents an unordered list of two actions and the discourse relation can be analysed as (formal) *Contrast* or *Parallel*. This case is similar to (23) discussed by Kamp and Rohrer (1983), see p. 18.

- (v) Marina prinjala vannu i Alena vključila televizor
 Marina take=PERF bath and₁ Alena turn-on=PERF TV
Marina took a bath so Alena turned on the TV.
- (vi) Marina prinjala vannu a Alena vključila televizor
 Marina take=PERF bath and₂ Alena turn-on=PERF TV
Marina took a bath whereas Alena turned on the TV.

läßt sich u. U. je nach Kontext, Texttyp, Textthema und Bedeutung der Einzelsätze ein impliziter temporaler, kausaler oder instrumental-modaler Zusammenhang etablieren. (Fabricius-Hansen, 2000, p. 339)

Translating this claim into SDRT terms gives largely the pattern in the first column of Table 2.1: temporal relations would presumably map to *Narration*, *Continuation*, *Parallel*, *Background* and formal *Contrast*; causal relations would subsume *Result* and *Explanation*; and what Fabricius-Hansen terms “instrumental-modaler Zusammenhang” corresponds roughly to *Elaboration*. All these relations can be established between paratactically juxtaposed sentences without connectives. Further, Fabricius-Hansen (2000, p. 339) notes that conditional interpretation (i.e. *Consequence*) is excluded between sentences connected paratactically, and in a later discussion of the same issues adds other non-veridical relations as well as concession to this group (Fabricius-Hansen, 2004).²³

Asyndetic connection between sentences in Russian seems to exhibit the same properties, and this will be illustrated by multiple examples in the following chapters. A brief look at some other languages, shows the same picture. For instance, the examples (71a)–(73a) present sentences with a *because*-clause in Russian, Hungarian, and Basque, and in examples (71b)–(73b) the *because*-clause is replaced by an independent sentence. The informants agreed that the (b) versions can be interpreted in more or less the same way as the (a) versions, so that the event of slipping on a banana peel is understood as the cause of falling.

(71) Russian:

- a. Vanja upal,
 Vanja fell
 potomu što (on) podskol’znulsja na bananovoj korke.
 because (he) slipped on banana peel
Vanja fell because he slipped on a banana peel.
- b. Vanja upal.
 Vanja fell
 On podskol’znulsja na bananovoj korke.
 he slipped on banana peel
Vanja fell. He slipped on a banana peel.

²³Other studies by Fabricius-Hansen and colleagues (Fabricius-Hansen and Behrens, 2001; Behrens and Fabricius-Hansen, 2002; Fabricius-Hansen, 2005) might create the impression that the function of asyndetic connection, in particular its occurrence with *Elaboration*, is subject to considerable cross-linguistic variation. The studies are based on a corpus of aligned German/English/Norwegian translations and report multiple cases where an explicit marker of *Elaboration* in one language, e.g. *indem* in German, is translated into another language by a pair of sentences connected asyndetically, and *vice versa*. Two remarks should be made in this connection. First, the methodology used in these studies (search automatically for a connective in the text of the original/translation and look at its counterpart in the translation/original) does not allow to capture asyndetic connections translated as asyndetic connections, since the texts are not annotated for discourse relations. If this could be done, perhaps the correspondences would outweigh the differences in the end. Second, the fact that the explicit realisation of *Elaboration* is in some contexts preferred to the implicit realisation does not tell us much yet about the general possibility of its implicit realisation in a particular language. Remember that the generalisations summarised in Table 2.1 concern the possibilities, i.e. whether a particular relation *can* be inferred given a particular mode of connection.

(72) Hungarian:

- a. János elesett mert elcsúszott egy banán=héj=on.
János fell.3SG because slipped.3SG a banana=peel=on
János fell, because he slipped on a banana peel.
- b. János elesett. Elcsúszott egy banán=héj=on.
János fell.3SG slipped.3SG a banana=peel=on
János fell. He slipped on a banana peel.

(73) Basque:

- a. John erori zen
John fell AUX
banana azal bat=ez irrista=tu bait=zen
banana peel one=INST slip=PART CAUSAL=AUX
John fell because he slipped on a banana peel.
- b. John erori zen.
John fell AUX
Bera(k?) banana azal bat=ez irrista=tu zen.
he banana peel one=INST slip=PART AUX
John fell. He slipped on a banana peel.

By contrast, a conditional marker cannot be simply removed. According to my informants, the examples (74a)–(76a) lose the conditional interpretation if the conditional subordinate clause is replaced by an independent sentence, cf. (74b)–(76b).

(74) Russian:

- a. Esli Vanja podskol'znulsja na bananovoj korke,
if Vanja slipped on banana peel
to on upal.
then he fell
If Vanja slipped on a banana peel, then he fell.
- b. Vanja podskol'znulsja na bananovoj korke.
Vanja slipped on banana peel
On upal.
he fell
Vanja slipped on a banana peel. He fell.

(75) Hungarian:

- a. Ha János elcsúszott egy banán=héj=on, akkor elesett.
if János slipped.3SG a banana=peel=on then fell.3SG
If János slipped on a banana peel, then he fell.
- b. János elcsúszott egy banán=héj=on. Elesett.
János slipped.3SG a banana=peel=on fell.3SG
János slipped on a banana peel. He fell.

(76) Basque:

- a. John banana azal bat=e_z irrista=tu izan ba=litz,
John banana peel one=INST slip=PART be.PART COND=AUX
erori=ko ziratekeen
fell=LTGEN AUX
If John slipped on a banana peel, he fell.
- b. John banana azal(a?) bat=e_z irrista=tu zen.
John banana peel one=INST slip=PART AUX
Bera erori=i zen.
he fell=PART AUX
John slipped on a banana peel. He fell.

These examples suggest that the inference of *Explanation* between two asyndetically connected independent sentences, as well as the impossibility of conditional relations with asyndetic connection, are at least widely spread phenomena. Of course, more systematic studies would be needed, to check whether the generalisations summarised in the first column of Table 2.1 are valid cross-linguistically, but the brief illustration presented above supports this hypothesis. Therefore, for the rest of this dissertation I will assume that the way asyndetic connection functions at the intersentential level is not specific to a particular language, and will regard relevant findings from different languages as equally compelling.

The next issue that will be considered is how the generalisations presented in this section are captured by the existing formal theories of discourse interpretation, and what other interesting ideas towards an analysis have been proposed, but not yet formalised. The main question addressed in the next sections is: how are implicit discourse relations inferred? The purpose is to provide the necessary background that will enable us to evaluate the existing theories as to how well they describe and explain the generalisations presented in this section, although the evaluation itself will be postponed till Section 2.5. In the next section (2.2) I will concentrate on “*and*-insensitive” relations and related proposals, as well as on more general theoretical proposals that have been made before the importance of *and* was properly realised by formal discourse semanticists. Section 2.3 then takes the role of *and* under closer consideration. Finally, Section 2.4 contains some theoretical remarks on relations that cannot remain implicit, be that with conjunction *and* or with the asyndetic connection.

2.2 Inferring implicit relations

This section will present some existing approaches to the inference of implicit semantic relations in discourse. This set of problems has received a lot of attention at least since Grice, but relatively few formal theories have been developed. As far as formal approaches are concerned, one should mention two major paradigms: (a) Discourse Representation Theory (DRT) and other varieties of “flat” dynamic semantics (e.g. Dekker, 1993; Veltman, 1996);²⁴ and (b) Segmented Discourse Representation Theory (SDRT). The two approaches share a

²⁴I will only refer to DRT below, but many facts concerning DRT are also valid of other dynamic theories.

large amount of formal machinery but take diverse positions on the theoretical status of discourse relations.

DRT rejects explicit representation of discourse relations in its formalism (Kamp and Rohrer, 1986, p. 32, fn. 17). Relations like *Narration*, *Elaboration*, *Explanation*, if talked about at all, are viewed as informal labels for certain bundles of linguistic facts (the way these terms were used in the previous section). DRT tries to model some of the facts that contribute to these ‘bundles,’ e.g. the temporal relations between eventualities, but does not ascribe any special status to the ‘bundles’ themselves. It should also be mentioned that DRT and other varieties of dynamic semantics have developed primarily as theories of discourse anaphora. As a practical consequence, these theories often present elaborate analyses of phenomena that lend themselves well to an account in terms of anaphora, but do not touch upon many others. This means essentially that DRT only attempts to account for those aspects of discourse relations that can be attributed to the function of some (explicit) *linguistic anaphoric device*.²⁵ By itself, DRT is not intended as a theory of conversational implicature, so it is not a coincidence that its role in modelling what we called ‘implicit discourse relations’ is rather limited. However, the analysis of temporal relations developed in the DRT framework deserves some of our attention in the current connection, so this group of DRT analyses will be discussed in this section.

By contrast, discourse relations play the most central role in SRDT. The whole range of facts discussed in Section 2.1 belongs to SDRT’s domain of primary concern. One could perhaps even say that SDRT tries to model *all* phenomena above the sentence level, thus it is intended as a general theory of linguistic pragmatics that should cover (among other things) speech acts and implicature. Moreover, discourse relations are not just an empirical notion, but also a theoretical construct in SDRT that is employed in modelling all these phenomena. Discourse relations are represented explicitly in the formalism, and a considerable part of the theory is devoted to the question how to infer these relations using a number of information sources, which do not only include explicit textual cues, but also lexical and world knowledge. This makes SDRT practically the only formal broad-coverage theory to date that has something to say on the main issue of this section—how implicit discourse relations are inferred.²⁶ Thus most of this section will be devoted to a presentation of relevant SDRT-based analyses, except that the issues concerning the distinction between the two modes of implicit connection—asyndetic connection and *and*-conjunction—will be left to Section 2.3.

The theories will be presented more or less chronologically, as they appeared on the market and captured a larger and larger set of discourse relations, involving more and more different information sources as the basis for inference. I will start with a brief presentation of some ideas of Grice that have been recycled in both DRT and SDRT (Section 2.2.1), and then continue with DRT analyses of temporal relations based on the interpretation of tense and aspect (Section 2.2.2). Section 2.2.3 discusses some problems faced by an approach such as DRT that does not feature discourse relations. Finally, Section 2.2.4 presents some techniques for inferring a number of discourse relations developed

²⁵The notion of anaphora is taken in a broad sense here to include, for instance, presupposition as well.

²⁶Recently, optimality theorists have turned their attention to discourse relations Zeevat (2005, e.g.). Some relevant ideas will be discussed in Chapter 7.

in the SDRT framework that are based on using a broad variety of knowledge sources including all sorts of lexical information as well as world knowledge. Although this approach already provides quite a good coverage of the data, I will try to show that there are still cases of implicit discourse relations that are not captured by these techniques, at least not in the way these techniques are used in the current versions of SDRT.

2.2.1 *Narration* and the Gricean Maxim ‘Be orderly’

It is an old and well-known observation that in a narrative text the textual order of sentences and clauses usually corresponds to the temporal order of the described events, which determines the discourse interpretation:

- (77) a. The lone ranger jumped on his horse and rode into the sunset.
 b. The lone ranger rode into the sunset and jumped on his horse.

Rather than attributing this behaviour to the semantics of *and*, Grice proposed to treat it as a *conversational implicature*—a maxim-driven pragmatic inference. That is, the hearer assumes that the speaker observes the conversational maxims, in particular, the fourth sub-maxim of the maxim of Manner that bids the speaker to *be orderly*, e.g. report the events in their order of occurrence (see e.g. Grice, 1975). This is the insight that stands behind the SDRT discourse relation of *Narration*, as well as behind various analyses of temporal relations that do not make use of discourse relations as a theoretical construct.

2.2.2 Tense, aspect, and temporal relations

The next observation that should be pointed out in connection with temporal structure is that the textual order principle mentioned above turns out to be sensitive to the way the eventualities are linguistically represented by means of tense and aspect. In particular, the temporal sequence effect only emerges if the described eventualities are (presented as) *punctual*, or events in the narrow sense. This is not the case if one of the sentences presents a *durative* eventuality that extends in time and does not have a natural limit:

- (78) a. If an eventuality is presented as punctual, it occurs later than another eventuality mentioned previously in the text.
 b. If an eventuality is presented as durative, it overlaps with another eventuality mentioned previously in the text.

Whether a particular sentence presents an eventuality as punctual or durative in the relevant sense depends on a number of factors. One of these factors is the inherent aspectual class (*Aktionsart*) of the main verb—*achievement*, *accomplishment* (punctual),²⁷ or *state*, *process* (durative), according to the classification proposed by Vendler (1967). The inherent aspectual class can be modified by tense and aspect morphology, the type of arguments taken by the verb, modifying adverbials etc. The following French examples demonstrate in particular the effect of tense morphology (Kamp and Rohrer, 1983, p. 253):

²⁷Strictly speaking, only achievements are literally punctual. Accomplishments can extend in time, e.g. *cross the street*, *read a book*. But the term ‘punctual’ is not used in this literal sense here. It applies to accomplishments in the sense that they have a natural limit point: if you cross the street (and everything goes fine), at some point you have crossed it.

(79) Pierre entra. Marie téléphona.

(80) Pierre entra. Marie téléphonait.

The inherent aspectual class of *entrer* ('enter') is achievement and that of *téléphoner* ('call') is process. However, the *passé simple* morphology on both verbs in (79) turns them both into punctual events. Therefore the discourse is interpreted as a temporal sequence: Pierre entered *and then* Marie made a phone call. In contrast, *téléphoner* in (80) has the form of *imparfait*, which in this case preserves the durative character of the verb. Thus a temporal overlap is expected, i.e. the discourse is interpreted so that Pierre enters at some point while Marie is talking on the phone.

It should be noted that naturally, different languages have different tense and aspect systems, so for instance, the English opposition of the simple and the progressive past, or the Russian opposition of perfective and imperfective aspect is not equivalent to the French *passé simple/imparfait* system. Nevertheless all these devices serve to contribute in one way or another to the punctuality/durativity of an eventuality description (see e.g. de Swart, 1998). Besides, the opposition of inherent aspectual classes is found in many languages, therefore one finds similar effects on the temporal interpretation of discourses in those languages, as in the English examples (81)–(83) from Hinrichs (1986, pp. 67–69), or the Russian examples (84) and (85) from Sannikov (1990, p. 212).

(81) Punctual + punctual, temporal succession:

The elderly gentleman wrote out the check,
tore it from the book and handed to Costain.

(82) Punctual + durative, temporal inclusion:

He awoke to the sound of screeching.
She was shaking him, screaming at him.

(83) Durative + durative, temporal overlap:

Jaime was building another boat.
He sang happily as he worked,
the muscles of his brown arms rippled in the sun...

(84) Punctual + punctual, temporal succession:

On sel i zapel
he sat-down.PERF and sang.PERF
He sat down and (then) started singing.

(85) Durative + durative, temporal overlap:

On sidel i pel
he sat.IMPERF and sang.IMPERF
He was sitting and singing.

This phenomenon—in particular the contribution of past tenses such as *passé simple* and *imparfait*—is analysed in DRT as a variety of anaphora (Kamp and Rohrer, 1986; Kamp and Reyle, 1993). Kamp and colleagues proposed that the semantic interpretation of tense morphemes introduces into the discourse representation structure (DRS) an eventuality variable which relates anaphorically to a reference time given by the context.²⁸ The type of relation between the

²⁸Cf. the Reichenbachian event time, reference time and speech time distinction.

newly introduced eventuality and the reference time is then determined by the tense: *passé simple* indicates that the current eventuality follows the reference time, whereas the *imparfait* indicates that the reference time is included in the current eventuality. Since the reference time is reset in each new sentence, a sequence of sentences in *passé simple* gives rise to an interpretation as a temporal succession where the temporal order matches the textual order. This analysis also ensures that the temporal succession is broken down by the sentences in the *imparfait*.

This approach, also adopted by Hinrichs (1986) for English, thus creates a more differentiated picture of the temporal structure of text than the Gricean maxim ‘be orderly,’ and captures (to some extent) the impact of tense and aspect, but makes it part of the texts’ semantics rather than pragmatics. This position was criticised by Dowty (1986) who tries to tease apart the semantic contribution of tense from the role played by general pragmatic principles. Further developments of the same basic ideas can be found in e.g. Moens and Steedman (1988), de Swart (1998), de Swart and Verkuyl (1999), and Nauze (2002). The temporal relations that all these proposals attempt to model play a role in distinguishing a number of discourse relations from the inventory introduced in Section 2.1. Temporal succession is characteristic of *Narration*, temporal inclusion of a punctual eventuality in a durative one as in (80) and (82) characterises *Background*, whereas temporal overlap of two duratives, cf. (83) and (85), can be analysed as *Continuation* or *Parallel*. However, the above mentioned theories are not intended to go beyond temporal relations to establish the discourse relations with all the additional implications that they bring along (e.g. constraints of the discourse topic, cf. Section 2.1.3, pp. 17–18). The next section will present some empirical difficulties this approach runs into and recapitulate the related arguments in favour of discourse relations as a theoretical construct proposed by Asher and Lascarides (Lascarides and Asher, 1993; Asher and Lascarides, 2003).

2.2.3 *Elaboration, Explanation* and the coming of discourse relations

There are three exceptions to the generalisation spelled out in (78) that escape an analysis along the lines of Kamp and Rohrer’s (1983; 1986) proposal, unless it is weakened considerably. These cases include the relations of type *Explanation* and *Elaboration*, as well as discourses that appear to list eventualities in an unordered fashion. Example (52b), repeated in (86), illustrates the first case, and (23)/(87) the other two.

(86) Max fell. John pushed him.

- (87) a. L’été de cette année-là vit plusieurs changements
dans la vie de nos héros.
b. François épousa Adèle,
c. Jean partit pour le Brésil
d. et Paul s’acheta une maison à la campagne.

Kamp and Rohrer admit that a sequence of French sentences that present punctual eventualities by means of the *passé simple* can convey temporal overlap or leave the temporal relation altogether unspecified. For instance in (87),

sentences (b), (c) and (d) introduce events that taken together *constitute* the changes mentioned in sentence (a), i.e. these events are part of the event introduced in the first sentence, and consequently they are temporally included in it. Secondly, the order of events in (b), (c) and (d) is not expressed by the discourse, i.e. (87) could be true if Paul's buying a house preceded Jean's departure for Brasil which occurred at the same time as François and Adèle's marriage. In view of these data, Kamp and Rohrer decide to relax the interpretation rule for *passé simple*: instead of requiring that the event introduced by the next *passé simple* sentence occur *later* than the previously introduced event, they change "later" to "not strictly prior." Temporally reversed interpretations as in the English discourse (86) are apparently less common with the French *passé simple*, so Kamp and Rohrer (1983, 1986) do not try to account for these, but the problem remains for English, as well as other languages.

In order to deal with these (and other) problems, Asher and Lascarides develop the SDRT framework in which the inference of temporal relations is mediated by the inference of discourse relations. Roughly, in order to obtain a reversed temporal order of the events in (86), it first has to be established on the basis of lexical and world knowledge that John pushing Max is a plausible *Explanation* for Max falling. Since *Explanation* entails causality, the pushing is understood as the cause for the falling, and since causes precede their effects, the pushing precedes the falling.

Asher and Lascarides (2003) argue at length for explicitly separating the process of establishing discourse relations such as *Elaboration*, *Explanation*, *Narration*, etc., from the process of interpreting them to arrive at their temporal consequences. One of their main arguments is the fact that there are pervasive correlations between the temporal structure of the text and various sorts of anaphoric relations between the sentences, which include individual anaphora, propositional anaphora, presupposition satisfaction and accommodation, as well as the interpretation of ellipsis. These correlations can easily be modelled if the constraints both on temporal interpretation and on anaphora resolution are stated in terms of a single mechanism, which Asher and Lascarides propose to identify with the hierarchical structure imposed by the discourse relations *Elaboration*, *Explanation*, *Narration*, etc., between the discourse segments. In other words, Asher and Lascarides view the phenomena mentioned above as providing independent motivation for introducing discourse relations as an explicit component of discourse structure. Once discourse relations are introduced temporal relations fall out automatically, and moreover, are modelled in an empirically more adequate way than by tense and aspect interpretation alone.

I will not recapitulate Asher and Lascarides argumentation for discourse relations here (the reader is referred to Asher and Lascarides, 2003, Chapter 2). In any case, I take it as established that the range of phenomena modelled in SDRT as effects of discourse relations should be captured by any complete theory of pragmatics and discourse interpretation, whether it employs discourse relations in the way SDRT does or not. In the next section, I will present some basic concepts of SDRT as well as a number of scenarios for the inference of implicit discourse relations that illustrate how the theory copes with the related phenomena. As before, my focus will stay on temporal and other semantic relations between eventualities and propositions, rather than anaphora.

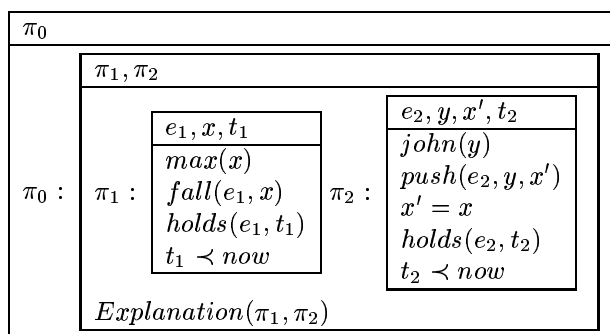


Figure 2.1: A sample SDRS

2.2.4 Inferring discourse relations in SDRT

Introduction

Following DRT, SDRT postulates a level of representation that captures discourse content—the *logical form* for discourse—but unlike DRT, discourse relations are represented explicitly at this level. Figure 2.1 gives an example of such a logical form—a segmented discourse representation structure (SDRS)—for the discourse in (88), where the sentences are connected by *Explanation*. Formally, *Explanation* is a predicate taking 3 arguments: the label of the SDRS that represents the content of the “explained” utterance, π_1 in Figure 2.1, the label of the “explaining” utterance, π_2 , and the label of the discourse constituent formed by the two utterances connected by the *Explanation* relation, π_0 . That is $Explanation(\pi_1, \pi_2, \pi_0)$.²⁹

(88) Max fell. John pushed him.

SDRT distinguishes two separate languages and logics: the language/logic of *information content*, and the *glue* language/logic. The level of information content deals with representing and interpreting logical forms, such as the SDRS in Figure 2.1. In particular, the semantic consequences of discourse relations, e.g. the reversed temporal order of events as a consequence of *Explanation*, are stated as meaning postulates in the logic of information content. The glue logic is in turn a device for modelling the process of inferring discourse relations, i.e. constructing logical forms like that in Figure 2.1 from the logical forms of individual sentences.³⁰

The logical forms of sentences supplied by the compositional semantics module may contain various sorts of *underspecification*, and they are always underspecified as to which previous utterance the current one is to be attached to by which discourse relation. That is, each utterance supplies an underspecified

²⁹In the DRS box representation style, only the first and the second argument (π_1 and π_2 in Figure 2.1) are written in parentheses after the relation symbol, whereas the third argument (π_0) is put in front of the SDRS separated by a colon. In the string representation style, $\pi_0 : Explanation(\pi_1, \pi_2)$ is equivalent to $Explanation(\pi_1, \pi_2, \pi_0)$.

³⁰In this sense, the glue logic is a device for *reasoning about* logical forms. The expressions of the glue language are representations of SDRSs and mirror their syntax (there is a straightforward translation from the language of information content into the glue language). The formal differences between the two languages can be ignored for the current purposes.

constraint, which in the glue language takes the form $?(α, β, λ)$, where $?$ is a place holder for the unknown discourse relation, and $α, β, λ$ are its three arguments: the label of the (yet unknown) attachment site, the label of the current utterance, and the label of the discourse constituent to be formed, respectively. Thus the inference of discourse relations amounts to resolving the underspecification in $?(α, β, λ)$. This task is fulfilled in the glue logic by a set of axiom schemata of the form in (89). Each such axiom schema is a *defeasible implication*, $>$, whose consequent specifies a discourse relation R , in place of ‘?’ . Next to $?(α, β, λ)$, the antecedent usually contains additional premises, “some stuff” in (89), which represent all sorts of information relevant for the inference of a particular discourse relation. This information is transferred into the glue logic from the logic of information content.

$$(89) [?(α, β, λ) \wedge \text{some stuff}] > R(α, β, λ)$$

It should be noted that only a limited subpart of the valid statements of information content is transferred into the glue language. The glue logic has access to the form of the logical forms, e.g. the logical correlates of connectives that occur in the sentence, or the tense information, such as $t_1 < \textit{now}$ in Figure 2.1. Some very restricted entailments of the logical forms may also get transferred into the glue language. For instance, some lexical inferences based on type hierarchies will be allowed, e.g. if $push(e, x, y)$ is true in the logic of information content and e is an event (as opposed to a state) then $event(e)(\pi_2)$ will be transferred into the glue logic. However, the major part of inferences that can be made on the basis of the whole load of information contained in the discourse context and the world knowledge base of the discourse participants will be banned from the glue logic. In this way, Asher and Lascarides (2003) make sure that the glue logic remains decidable, and at the same time make a statement about (human) discourse processing. When figuring out the way in which an utterance fits in its context, not all valid information is being considered, but only the information immediately associated with the linguistic expressions used in the utterance and the context. The empirical validity of this claim will not be discussed.

Next, a few words should be said on the way the inference of discourse relations proceeds using axiom schemata like (89). As already mentioned, these axiom schemata are generally defeasible, i.e. they are default rules whose consequences can be overridden under certain circumstances. The non-monotonic glue logic regulates this process. Some of the most important laws by which the default rules interact with each other and with monotonic inferences are spelled out in (90), (91), and (92), together with the informal glosses given by Asher and Lascarides (2003, pp. 190–191).

(90) **Defeasible Modus Ponens:**

When the default laws in T whose antecedents are verified by the premises all have consequents that are consistent with T and with each other, then all the consequents of the defaults are valid inferences under \sim . In particular, the following hold:

$$\begin{aligned} A, A > B &\sim B \\ A, A > B, \neg B &\not\sim B \end{aligned}$$

(91) **The Specificity (“Penguin”) Principle:**

When conflicting default rules apply, only the consequent of the most specific default rule (if there is one) is inferred. In particular:

$$\text{If } \vdash A \rightarrow C \text{ then } A > \neg B, C > B, A \not\sim \neg B$$

(92) **The Nixon Diamond:**

When conflicting default rules apply, but no default is more specific than the others, the consequents of these default rules cannot be inferred. In particular:

$$\begin{aligned} A > B, C > \neg B, C, A \not\sim B \\ A > B, C > \neg B, C, A \not\sim \neg B \end{aligned}$$

Note that \sim in (90), (91), and (92) is the non-monotonic consequence relation, the defeasible counterpart to \vdash .

The non-monotonic inference rules of the glue logic are designed to produce a set of pragmatically preferred (rather than all possible) specifications of the underspecified logical forms provided by the compositional semantics module. However, the resulting set of SDRS representations will still include “better” and “worse” candidates, more coherent and less coherent SDRS’s. There are a number of factors that determine the relative coherence of discourse representations, which include for instance consistency and complexity of the SDRSs (Asher and Lascarides, 2003, pp. 230–238).³¹ Another factor concerns the strength of rhetorical connections between utterances. This has two aspects. First, one and the same utterance can be connected by more than one discourse relation to some utterance(s) in the context. An SDRS that specifies more discourse relations is considered more coherent. Second, certain discourse relations have graded quality. Some such cases were already mentioned in Section 2.1.3, pp. 17–18. For example, utterances connected by *Narration* must have a *common topic*. If a topic is understood as the common content or ‘summary’ of the logical forms of two sentences, then the more informative this summary is, the better the *Narration*. Other discourse relations that undergo similar quality ratings are *Continuation*, *Parallel*, and *Contrast*. An SDRS is considered more coherent if it features better-quality relations. Finally, the last factor that affects relative discourse coherence has to do with the number of unresolved underspecifications: the fewer unresolved underspecifications the SDRS contains the more coherent it is. Once the output SDRSs of the glue logic module are ranked according to these factors, the *Maximise Discourse Coherence* (MDC) principle tells us to select the best SDRS, which is then taken to represent the ultimate discourse structure for the current discourse.

If the mechanisms sketched out above fail to produce a discourse representation where all the underspecified discourse relations $?(α, β, λ)$ have been specified in a consistent way, then the discourse is predicted to be incoherent. This reflects the idea that in a coherent discourse all utterances are connected by discourse relations into a single graph. If there is exactly one most coher-

³¹Consistency and complexity are the hardest constraints on relative coherence. They will play little role in the discussion in the next sections, as they will always be assumed to be met in the discourse structures considered here. Therefore, I will skip a detailed introduction.

ent SDRS, then the discourse is predicted to be coherent, whereas if there is more than one coherent output SDRS after applying the MDC principle, the discourse is taken to be marginally suboptimal. The interpreter cannot decide on the intended reading of the discourse.

The next subsections will present a number of examples that illustrate the theory at work. SDRT strategies for inferring some specific discourse relations will be presented. In particular, I will concentrate on the inference of *Elaboration* (including its special cases *Particularisation* and *Generalisation*), *Explanation*, as well as *Narration*. A few words will also be said on the general mechanism of “backward spreading” of discourse relations, as well as on the SDRT treatment of explicit discourse relations signalled by cue phrases. This choice of issues is motivated by the purpose to provide necessary background that will enable us to evaluate the predictions of SDRT with respect to the observed regularities regarding the explicit/implicit realisation of discourse relations in the broad empirical perspective set out in Section 2.1. The evaluation of the theory will, however, be postponed till Section 2.5.

Elaboration & Co.

To begin with, let’s consider an SDRT analysis of examples like (93) from Asher and Lascarides (2003, p. 282), as well as discourses like (40) discussed in Section 2.1.3 and repeated in (94) below.

- (93) a. Max ate a lovely meal.
 b. He devoured lots of salmon.
- (94) a. Fred damaged a garment.
 b. He stained a shirt.

Asher and Lascarides (2003, pp. 282–283) analyse such discourses as instances of *Elaboration*. The inference of *Elaboration* here relies massively on the lexical type hierarchies, i.e. hyponymy/hyperonymy relationships specified in the lexicon. Suppose x is the referent of *a garment* and y is the referent of *a shirt* in the corresponding SDRSs. Then the information that *shirt* is a hyponym of *garment* will be reflected in the glue logic by the constraint $y \sqsubseteq x$. Similarly, if e_α is the event of damaging and e_β is the event of staining, the lexical knowledge that the latter is a subtype of the former will be transferred to the glue logic as $e_\beta \sqsubseteq e_\alpha$. Moreover, the garment and the shirt occupy the same patient θ -roles of the respective verbs. But if clauses α and β both have theta roles θ_i , the argument of θ_i in β is a lexical subtype of the argument of θ_i in α , and the head event of β is a lexical subtype of the head event of α , then this is *evidence* that β is a subtype of α , i.e. $subtype_D(\beta, \alpha)$.³² The rule in (95), which is a monotonic rule in glue logic, captures this idea.

- (95) **Subtype:**
 $[\theta_i(x, \alpha) \wedge \theta_i(y, \beta) \wedge y \sqsubseteq x \wedge e_\beta \sqsubseteq e_\alpha] \rightarrow subtype_D(\beta, \alpha)$

If the discourse provides evidence that β is a subtype of α then *Elaboration*

³²According to Danlos (1999), not just the arguments of some, but of all corresponding θ roles of the clauses must stand in subtype or coreference relation, in order to verify the antecedent of such a rule. I will ignore these details here.

can be inferred by default by the axiom schema (96).³³ The rule says that if α is to be attached to β with some discourse relation (yet unknown, cf. ?) and the content of this attachment is to be assigned the label λ , and there is evidence in the discourse that β is a subtype of α then normally $Elaboration(\alpha, \beta)$ holds regardless of the aspectual classes of α and β ($Aspect(\alpha, \beta)$).³⁴

(96) Elaboration:

$$[?(\alpha, \beta, \lambda) \wedge subtype_D(\beta, \alpha) \wedge Aspect(\alpha, \beta)] > Elaboration(\alpha, \beta, \lambda)$$

Once the *Elaboration* relation is established, it can be interpreted in the logic of information content. In particular, the meaning postulate for *Elaboration* guarantees that the main eventualities e_α and e_β of the constituents α and β stand in a part-whole relation, where e_β is part of e_α (Asher and Lascarides, 2003, p. 461):

(97) Semantic Consequence of Elaboration:

$$\phi_{Elaboration(\alpha, \beta)} \Rightarrow Part-of(e_\beta, e_\alpha)$$

As already mentioned in Section 2.1.3, pp. 22–24, Danlos (1999) proposes a stronger analysis of discourses like (94) which predicts not just a part-whole, but also a coreference relation between the eventualities, via the inference of a *Particularisation* or a *Generalisation* relation. If Danlos' proposal is to be integrated in the SDRT framework of Asher and Lascarides (2003), the default axiom schemata for these relations would look presumably like (98) and (99), whereas (100a) and (100b) would be the corresponding meaning postulates.³⁵

(98) Particularisation:

$$[?(\alpha, \beta, \lambda) \wedge subtype_D(\beta, \alpha) \wedge Aspect(\alpha, \beta)] > Particularisation(\alpha, \beta, \lambda)$$

(99) Generalisation:

$$[?(\alpha, \beta, \lambda) \wedge subtype_D(\alpha, \beta) \wedge Aspect(\alpha, \beta)] > Generalisation(\alpha, \beta, \lambda)$$

(100) Semantic Consequences of Particularisation and Generalisation:

- a. $\phi_{Particularisation(\alpha, \beta)} \Rightarrow e_\beta = e_\alpha$
- b. $\phi_{Generalisation(\alpha, \beta)} \Rightarrow e_\beta = e_\alpha$

Since both relations are compatible with *Elaboration*, they can be inferred together with *Elaboration*. An SDRS that features, for instance, both *Particularisation* and *Elaboration* will be preferred to one without *Particularisation* due to the MDC Principle. Thus the prediction for (94) is that the event of staining the shirt *is* the event of damaging the garment, and not just part of it.

Under this approach, the inference of *Elaboration* in the proper sense would require different lexical information and different default axiom schemata (Danlos, 1999; Danlos and Gaiffe, 2004). This concerns the cases of proper part relations between eventualities, such as (38), repeated in (101). One would have to assume that the lexicon or the world knowledge contains the infor-

³³Note that (96) follows the general pattern (89) for default axiom schemata of discourse relations. Note also that some details were suppressed in (96). See Asher and Lascarides (2003, p. 206) for full details.

³⁴The $Aspect(\alpha, \beta)$ premise that encodes the idea that the inference of *Elaboration* should be unaffected by the aspectual class, is strictly speaking an informal abbreviation for a number of different default inference rules (Asher and Lascarides, 2003, p. 206). I skip the details here, but return to this matter in Section 2.3.3.

³⁵ e_α and e_β in (100) stand for the main eventualities of α and β .

mation that events of certain types are subdivided into “typical stages,” e.g. drawing plans is a typical stage (a preparatory phase) of building bridges, along the lines of Moens and Steedman (1988) and Lascarides and Asher (1993). This information is transferred into the glue logic, and then presumably it counts as discourse evidence for a preparatory phase relation between the DRSs, e.g. *preparatory-phase_D(β, α)*, which in turn serves as an antecedent to a default axiom schema for *Elaboration*, cf. (102). The actual part-whole relation between the eventualities is only inferred by (97) at the stage of SDRS interpretation.

- (101) a. The council built the bridge.
 b. The architect drew up the plans.

(102) **Elaboration (proper):**

$$[?(\alpha, \beta, \lambda) \wedge \textit{preparatory-phase}_D(\beta, \alpha) \wedge \textit{Aspect}(\alpha, \beta)] > \textit{Elaboration}(\alpha, \beta, \lambda)$$

Danlos (1999) argues for the inference of a stronger relation between eventualities—coreference rather than just a part-whole relation wherever this is consistent—in order to account for the phenomenon of coreference between indefinite NPs which shows up pervasively in *Particularisation* and *Generalisation* discourses, and thus constitutes a systematic exception to the well-established view that indefinite NPs introduce new discourse referents (Heim, 1982). For instance, *a shirt* in (94) refers to the same individual as *a garment* in the preceding sentence, even though it has an indefinite article. However, once event coreference is established, the participants filling the corresponding semantic roles can be identified, too. Thus, since both *a garment* is an object of damaging, and *a shirt* is an object of staining, the coreference of these NPs follows from the coreference of the damaging and the staining events. This nice consequence could not be (easily) maintained if only a part-whole rather than a coreference relation were inferred in (94).

To summarise, SDRT bases the inference of implicit *Elaboration* and related discourse relations on the lexical information (hyponymy/hiperonymy hierarchies) and world knowledge. This implies that if such information is not available to the hearer, presumably, he or she will not be able to infer *Elaboration* in the absence of overt cues. However, there seem to be cases which cast doubt on this view. Recall Blakemore’s (1997, p. 8) example (45) discussed in Section 2.1.3, p. 23, repeated in (103).

- (103) At the beginning of this piece there is an example of an anacrusis.
That is, it begins with an unaccented note which is not part of the first full bar.

Blakemore argues that the communicative purpose, the main point of this discourse, is to explain the term *anacrusis* to someone who does not know what that is, which is achieved by means of a *Reformulation*. In this particular case the hearer can infer *Reformulation* on the basis of the cue phrase *that is*. However, it seems that the same effect can be achieved by a discourse without a cue phrase:

- (104) At the beginning of this piece there is an example of an anacrusis.
 It begins with an unaccented note which is not part of the first full bar.

In other words, someone who does not know that the word *anacrusis* is syn-

onymous with *unaccented note which is not part of the first full bar* would be able to infer it from (104), presumably as a consequence of establishing *Reformulation*. However, the question is, how does the hearer establish *Reformulation* in this case, if (s)he neither possesses the relevant knowledge of synonymy relations, nor is there a cue phrase to rely on? This example presents a potential problem to an analysis along the lines of Danlos (1999) and Asher and Lascarides (2003). If implicit *Reformulation* is to be analysed in the same way as other *Elaboration*-class relations, e.g. *Particularisation* or *Generalisation*, so if it is only to be inferred on the basis of supporting lexical or world knowledge, then one should never be able to use implicit *Reformulations* to introduce new terms. This suggests that some other pragmatic mechanisms are at work in examples like (104) which guarantee the inference of the appropriate relation. My tentative proposal is that a relation from the *Elaboration* family is inferred by default in (104) as well as in other cases. In the following sections I will elaborate on this idea, but first let's consider related observations concerning *Explanation*.

Explanation

SDRT distinguishes between two major cases regarding the inference of *Explanation*. The choice of inference strategy depends on whether or not the event in one of the sentences is introduced by a lexical item that specifies a causal relation in one way or another directly in its lexical entry.

There is a number of theoretical proposals that try to exploit causal relations specified in the lexicon for inferring causal relations at the intersentential level, including Kamp and Roßdeutscher (1994a,b), Danlos (2001), Danlos and Gaiffe (2004), Asher and Lascarides (2003, pp. 264–279).³⁶ I will first try to present the basic idea in a neutral fashion and then mention some of the most relevant specifics of the particular theories.

Causal relations constitute part of the lexical semantics of a variety of verb classes. The first ones to mention are causative verbs like English *sink*, *roll*, *crack* or German *heilen* (Pustejovsky, 1991, 1995; Kamp and Roßdeutscher, 1994b; Levin, 1995; Danlos, 2001), but also psychological verbs like *annoy*, *frighten*, as well as “force movement” verbs like *push* have been argued to involve causality (see Asher and Lascarides, 2003, 269–271, for motivation and further references). For example, the rough idea behind the lexical entry for *push* is shown in Figure 2.2. Note that it does not only mention the event of pushing itself, e , i.e. the event in which an agent applies physical force to an object, but also the process e' of movement to which that object is set by the applied force. The entry also explicitly specifies that the event *causes* the process, $CAUSE(e, e')$.

This information is further used for establishing a causal relation between the falling and the pushing event in discourses like (86), repeated in (105). Suppose the SDRS of the second sentence is integrated with the SDRS of the first as shown in Figure 2.3.³⁷ If the movement e_3 introduced into π_2 by the lexical entry of *push* is now identified with the eventuality e_1 of falling in π_1 , the causal relation between e_2 and e_1 follows automatically: $CAUSE(e_2, e_3)$,

³⁶Kamp and Roßdeutscher's proposal is cast in the framework of classical DRT, rather than SDRT, so their theory concerns the inference of causal relations between events, rather than *Explanation* relations between speech acts.

³⁷Tense information is suppressed in Figure 2.3, cf. Figure 2.1 on p. 43.

$\lambda e\lambda y\lambda x$	e'
	$push(e, x, y)$
	$move(e', y)$
	$CAUSE(e, e')$

Figure 2.2: A lexical entry for *push*

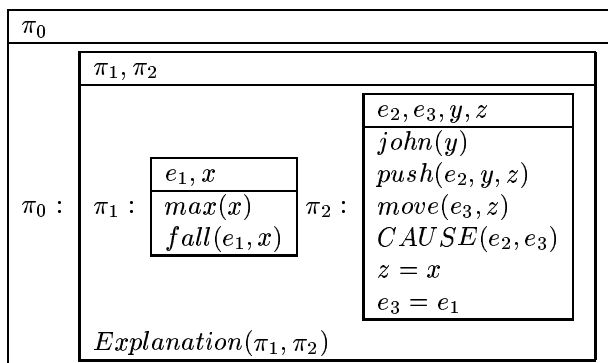


Figure 2.3: The resulting SDRS for (105): Max fell. John pushed him.

$e_3 = e_1$, hence $CAUSE(e_2, e_1)$. Note that e_1 and e_2 are the main eventualities of π_1 and π_2 and the direction of the causal link is reversed with respect to the textual order. Thus, a very simple inference rule would suffice to get *Explanation*(π_1, π_2).

(105) Max fell. John pushed him.

Obviously, the crucial move of this inference is identifying the movement eventuality e_3 with the falling eventuality e_1 . But how does this identification come about? Different researchers give different answers to this question. Kamp and Roßdeutscher (1994a, pp. 228–232) have suggested that the eventualities are identified only if an elaboration-type relation can be established between the corresponding DRSS. The same idea is developed by Danlos (2001) and Danlos and Gaiffe (2004). If this approach is applied to *push* and discourses like (105), one would presumably take it that the $push(e, x, y)$ and the $move(e, y)$ components of the lexical entry of *push*, cf. Figure 2.2, are supplied with their own SDRS labels, e.g. $\pi : push(e, x, y)$ and $\pi' : move(e', y)$, so they can participate in discourse relations like first class discourse constituents (cf. e.g. Asher and Lascarides, 2003, p. 271).³⁸ Thus suppose that the SDRS for (105) in Figure 2.3 labels $move(e_3, z)$ as $\pi_3 : move(e_3, z)$. Since *fall* is a hyponym of *move*, a *subtype_D* relation can be established between π_1 and π_3 by a rule like (95): *subtype_D*(π_1, π_3). Then the default axiom schema for *Generalisation* (99) can apply, so the *Generalisation* relation is established between the SDRS π_1 of the first sentence and the (linguistically unrealised) constituent π_3 .³⁹ The corefer-

³⁸It should be noted that both Kamp and Roßdeutscher (1994a) and Danlos and Gaiffe (2004) develop their analyses only for causative verbs, but the current application to a “force movement” verb like *push* seems like a natural generalisation.

³⁹Verifying the antecedent of the *Generalisation* axiom (99) would require an additional

ence of e_1 and e_3 would then follow from the *Generalisation* meaning postulate (100b).

Asher and Lascarides (2003, pp. 273–279) use a simpler and more radical method for establishing the coreference of the falling and the implicit movement eventualities in (105). They propose, roughly, that the moving event introduced by the lexical entry of *push* behaves like an anaphoric pronoun in that it searches the context for an antecedent to identify with. Pronouns like *him* in SDRT introduce underspecified constraints of the form $z = ?$, whereas the *Maximise Discourse Coherence* principle is designed to resolve as many such underspecifications as possible (e.g. $z = ?$ is resolved to $z = x$ in Figure 2.3). One could formalise the contribution of the implicit movement eventuality in the lexical entry of *push* (Figure 2.2) in a completely parallel fashion by introducing a constraint $e' = ?$. Thus $e_3 = ?$ would be added to the SDRS in Figure 2.3. Since nothing prevents identifying e_3 with e_1 (*move* is compatible with *fall*), MDC will identify them.⁴⁰

The two methods of establishing event coreference mentioned above—via inferring *Generalisation* or *Particularisation*, and via underspecification resolution by MDC—seem to be largely compatible. The method that uses *Generalisation* or *Particularisation* is, of course, more conservative since it requires that the full description of the one eventuality be a subtype of the other, whereas the method based on resolving underspecification works even if the two descriptions are simply compatible and can be “unified.”⁴¹ Danlos and Gaiffe (2004) argue that the former procedure should be preferred and provide data that suggest that *Explanation* can only be inferred via establishing *Particularisation*, and not *Generalisation*.⁴² However, even if Danlos and Gaiffe’s argumentation goes through for causal *Explanations* based on causative verbs (what they concentrate on primarily), it is not clear to what extent it is applicable to the case of verbs like *push*. As the above analysis of (105) shows, *Explanation* goes unproblematically with *Generalisation* here. In other words, comparing Danlos and

assumption that an underspecified constraint of the form $?(α, π_3, λ)$ is introduced (“look for a discourse relation and a site to attach $π_3 : move(e_3, z)$ ”). I will not discuss how and why this would be ensured.

⁴⁰Asher and Lascarides’ original formalisation differs in a number of details (see Asher and Lascarides, 2003, p. 271). First, the underspecification associated with the implicit movement eventuality is captured by a constraint $π' : ?^{Move}(e', y)$, which underspecifies $π'$ rather than the identity of e' . Second, instead of a causal relation between eventualities, the lexical entry of *push* establishes the discourse relation of *Result* directly between the constituent sub-DRSs: $Result(π, π')$, $π : push(e, x, y)$, $π' : ?^{Move}(e', y)$. The MDC would then resolve the underspecified $π_3$ in Figure 2.3 directly to $π_1$. Thus $Result(π_2, π_1)$ is established, and $Explanation(π_1, π_2)$ is drawn as the reversed ‘dual’ to *Result*, (see Asher and Lascarides, 2003, pp. 273–274). The analysis based on *CAUSE* and $e' = ?$ is introduced above for purely presentational purposes, primarily for the ease of comparison to Kamp and Roßdeutscher (1994a,b) and Danlos (2001). Nevertheless it retains the most relevant features of Asher and Lascarides’ original proposal. The implicit movement eventuality behaves essentially as an anaphoric device and most of the work is done by the MDC principle.

⁴¹Danlos (1999) considers “unification” as a possible procedure for inferring *Particularisation* but argues against this solution on the basis of the infelicity of the examples like (i), where the hyponymy relations are mixed with hyperonymy: *take care of* > *prune*, but *cedar* < *tree*.

(i) # Fred took care of a cedar. He pruned a tree.

At the same time she acknowledges that *Particularisation* discourses may mix hyponyms with hyperonyms under certain conditions. I will ignore this complex matter here.

⁴²The reverse is argued for *Result*.

Gaiffe’s with Asher and Lascarides’ approach is a complex matter, so it will be left aside.

To summarise so far, when a causal relation is imported into the discourse structure directly from the lexicon, inferring a (causal) *Explanation* relation between sentences boils down to establishing coreference links between the appropriate eventualities. Now I shall briefly mention the other case, where *Explanation* is inferred in the absence of such lexical information, and the related proposal of Asher and Lascarides (2003, p. 279–282).

For example, in the discourse (106), adapted from Asher and Lascarides (2003, p. 280), an *Explanation* relation is inferred although there is no obvious reason to assume that a causal relationship between a hitting and a crying-type event is conventionalised as part of their lexical entries.

- (106) a. Susan cried.
 b. John hit her.

The inference of *Explanation* in this case makes extensive use of the glue logic and is largely parallel to the inference of *Elaboration*, presented earlier. The crucial assumption is that the domain knowledge supports the inference in (107), that, roughly, if a mention of crying and a mention of hitting co-occur in discourse this counts as *discourse evidence* for a causal relation (*cause_D*) between the two.

$$(107) [?(\alpha, \beta, \lambda) \wedge cry(e_\alpha, x) \wedge hit(e_\beta, y, x)] \rightarrow cause_D(\beta, \alpha)$$

This bit of domain knowledge is transferred into the glue logic and is used to verify the antecedent of the default axiom schema for *Explanation* (cf. Asher and Lascarides, 2003, p. 206):

(108) **Explanation:**
 $[?(\alpha, \beta, \lambda) \wedge cause_D(\beta, \alpha) \wedge Aspect(\alpha, \beta)] > Explanation(\alpha, \beta, \lambda)$

Finally, the temporal consequences of *Explanation*, e.g. that the hitting preceded the crying, are extracted with the help of the meaning postulates in (109), see Asher and Lascarides (2003, p. 462).

(109) **Temporal Consequences of Explanation:**

- a. $\phi_{Explanation(\alpha, \beta)} \Rightarrow [\neg e_\alpha \prec e_\beta]$
 b. $\phi_{Explanation(\alpha, \beta)} \Rightarrow [event(e_\beta) \Rightarrow e_\beta \prec e_\alpha]$

Asher and Lascarides (2003, p. 278) argue that in spite of the availability of this alternative strategy for inferring *Explanation*, the strategy that is based on conventionalised lexical information should be exploited to the utmost, since it helps reduce the complexity of reasoning. It is also essential in cases where causal relations are not supported by domain knowledge.

The inference strategies presented above—the one based on lexical knowledge and the one based on world knowledge—are the only two strategies that SDRT in its current version intends for the inference of *Explanation* in the absence of overt cues. This view implies that *Explanation* can only remain implicit if its inference is supported either by the lexicon or by world knowledge. In this light it is interesting to note the examples in (110) discussed by Carston (2002, p. 236). The discourse in (110a) is a clear case of *Contrast* which is perfectly in

line with world knowledge since normally linguists can read.⁴³ As for (110b), the discourse strikes one as contradictory at first glance, however, if it is to receive a consistent interpretation, then the most available one is that of *Explanation*, i.e. the fact that Max is a linguist is taken to explain the fact that he cannot read, which runs contrary to world knowledge.

- (110) a. Max can't read *and* he's a linguist.
 b. Max can't read. He's a linguist.

Examples like (110b) present a difficulty for Asher and Lascarides (2003), since the inference of *Explanation* is not supported by anything here—neither world knowledge, nor the lexical properties of the words involved, nor an overt cue phrase like *because*. This problem is reminiscent of the one we encountered in connection with implicit *Reformulations* like (104) discussed above. Once again, we have a case where inference of an implicit relation takes place, but nothing seems to be there to trigger this inference. These observations suggest that there is a strong bias towards inferring *Explanation* between asyndetically connected sentences in the absence of cues to other discourse relations. Like *Reformulation*, it seems that *Explanation* is a default interpretation for asyndetic connection, moreover, this default is quite strong and cannot be easily overridden by world knowledge, as (110) shows. This is in line with Carston's (2002) proposal, but contrasts sharply with the standard assumptions in the SDRT framework. In Section 2.3, I will point out some further observations that can be attributed to this default *Elaboration/Explanation* bias, but that have received a different analysis in SDRT. However, first some more background needs to be introduced.

Narration

The last SDRT discourse relation whose inference should be considered in some detail is *Narration*. In the early versions of SDRT (see e.g. Lascarides and Asher, 1993) *Narration* was always inferred by default, which was intended in a way as an implementation of the Gricean principle “be orderly” as the most basic interpretation principle for sequences of sentences, cf. Section 2.2.1. In the formalism introduced above, the default axiom schema for *Narration* would look roughly like $?(α, β, λ) > Narration(α, β, λ)$.⁴⁴ Obviously, whenever there was a possibility to infer some other relation incompatible with *Narration*, that relation would be preferred. For example, *Elaboration* and *Explanation* are inconsistent with *Narration*, primarily due to their incompatible temporal consequences. But the default axiom schemata for *Elaboration* (96) and *Explanation* (108) have more specific antecedents, hence they would override *Narration* due to the “Penguin” Specificity Principle (91). This analysis reflected the idea that *Narration* is always inferred unless there is evidence to the contrary.

However, in view of examples like (32a), repeated in (112), Asher and Lascarides (2003, p. 200) dropped the idea of *Narration* as default. As already mentioned in Section 2.1.3, p. 20, (112) as is, without a continuation, is not perfectly coherent and is not understood as a narrative sequence. However, the earlier versions of SDRT that made use of *Narration* as default predicted a *Narration* relation between these sentences.

⁴³A similar example (65) was discussed in Section 2.1.3, pp. 29–30.

⁴⁴Lascarides and Asher (1993) were using a somewhat different formalism, but the differences are not essential.

(111) What did Kim do today?

(112) ? Kim watched TV. She studied.

In SDRT'2003, *Narration* can be inferred in the absence of overt cues only if the domain knowledge supports that the first mentioned eventuality “occasions” the second. That is, there’s a plan or a ‘natural event-sequence’ such that events of the sort described by the first constituent α lead to events of the sort described by the second constituent β , (Asher and Lascarides, 2003, pp. 200–201). The new axiom schema for *Narration* that realises this idea is given in (113):

(113) **Narration:**

$$[?(\alpha, \beta, \lambda) \wedge occasion(\alpha, \beta)] > Narration(\alpha, \beta, \lambda)$$

“Occasion” is inferred in a similar way as *subtype_D* and *cause_D* are, by means of transporting domain or lexical knowledge into the glue language. One important difference is, however: whereas *subtype_D* and *cause_D* are inferred indefeasibly, cf. “ \rightarrow ” in (95) and (107), occasion generally follows the defeasible scheme in (114), cf. “ $>$ ” (Asher and Lascarides, 2003, p. 201):

(114) **Occasion:**

$$?(\alpha, \beta, \lambda) \wedge \phi(\alpha) \wedge \psi(\beta) > occasion(\alpha, \beta)$$

This is an essential difference if one wants to maintain that *Elaboration* and *Explanation*, whenever they can be established, override *Narration*. Asher and Lascarides postulate that *subtype_D* and *cause_D* are inconsistent with *occasion*. Since monotonic information always overrides conflicting default inferences, *occasion*(α, β) is not inferred, even if the antecedent of a rule like (114) is satisfied (Asher and Lascarides, 2003, p. 207).

In the rest of this section, I will briefly mention some general patterns for inferring discourse relations in SDRT that are not relation-specific.

“Backward spreading” of discourse relations

First, recall the phenomenon mentioned in Section 2.1.3, pp. 19–20, which is characterised by a sort of “backward spreading” of a discourse relation. Once again, the idea is that a discourse like (116) sounds somewhat odd because the hearer cannot decide how to connect the second sentence to the first one. However, when the third sentence is processed containing the cue *then* that signals *Narration*, cf. (117), the *Narration* relation is established not only between sentences (117b) and (117c), but also between sentences (117a) and (117b). That is, *Narration* “spreads” from the sentence containing the cue phrase back to the sentences with a yet unspecified relation (Asher and Lascarides, 2003, pp. 182–183, 200).

(115) What did Kim do today?

(116) ? a. Kim watched TV.

b. She studied.

(117) a. Kim watched TV.

b. She studied.

c. *Then* she went out.

This behaviour is captured by the following default inference rule (Asher and Lascarides, 2003, p. 203):

$$(118) [?(\alpha, \beta, \lambda) \wedge R(\beta, \gamma, \lambda')] > R(\alpha, \beta, \lambda)$$

However, I think there are some problems with (118), both concerning the particular way it is formulated, and the role it plays in explaining the difference in coherence between (116) and (117). Concerning the first point, note that Asher and Lascarides see (118) as a general rule that is not only valid for *Narration*, but in principle for any discourse relation *R*. One can easily find similar examples where discourse relations do not spread, and some relations seem to be incapable of backward spreading altogether. The ‘denial of expectation’ type of *Contrast* seems to be one such case. In (119), for instance, *Contrast* is signalled by the connective *but* in (119c). If it spread backwards according to the schema in (118), then the same relation would be established between the first two sentences (119a) and (119b). In that case (119) should be paraphrasable as (120), which is obviously not right.

- (119) a. Kim watched TV.
 b. She studied.
 c. *But* she still made it to the airport.

- (120) a. Kim watched TV.
 b. *But* she studied.
 c. *But* she still made it to the airport.

As far as the second point is concerned—the role played by a rule like (118) in accounting for the coherence of (117) *vis-à-vis* the somewhat suboptimal character of (116)—the discussion of this point will be postponed until Section 2.3.3, after we have dealt with the contribution of the conjunction *and*.

Explicit relations in SDRT

Finally, a few words should be said on what was called “explicit” discourse relations in Section 2.1.1. Asher and Lascarides (2003) touch rather superficially upon the issue of cue phrases that signal discourse relations. From what one can gather, the contribution of cue phrases to the discourse structure can be formalised in two ways. Either a discourse relation constitutes the semantics of a lexical connective, e.g. *Consequence* for *if*, and is imported into the discourse structure already at the stage of the compositional semantic interpretation of the sentences (Asher and Lascarides, 2003, p. 239); or the information on cue phrases is used in the inferences of the glue logic, as shown below (cf. Asher and Lascarides, 2003, pp. 202, 208, 211):

$$(121) [?(\alpha, \beta, \lambda) \wedge \textit{and-then}(\alpha, \beta)] \rightarrow \textit{Narration}(\alpha, \beta, \lambda)$$

$$(122) [?(\alpha, \beta, \lambda) \wedge \textit{but}(\alpha, \beta)] \rightarrow \textit{Contrast}(\alpha, \beta, \lambda)$$

$$(123) [?(\alpha, \beta, \lambda) \wedge \textit{so}(\beta)] \rightarrow \textit{Result}(\alpha, \beta, \lambda)$$

If the inference rules associated with cue phrases are made indefeasible (as those presented above are, mind the “ \rightarrow ”) the corresponding inferences override all conflicting default inferences and they themselves cannot be cancelled; neither can the compositional semantics of sentences (cf. the case of *if*). Thus it

seems to be general practice in SDRT to analyse explicit discourse connectives as making a *monotonic* contribution to the discourse structure in one way or another. However, this is a practice, and not a law. In Section 2.5 we will discuss a case where, according to Asher and Vieu’s (2005) suggestion, a connective (in particular *and*) gives rise to a non-monotonic inference. In other words, it should be emphasised once again that explicit relations are treated in SDRT in essentially the same way as implicit relations. In general, cue phrases participate in the inference of discourse relations like any other sources of information such as information on tense and aspect, lexical, and domain knowledge. In this sense SDRT does not make a fundamental distinction between explicit and implicit communication.

2.2.5 Summary

In this section I presented some insights concerning the inference of implicit relations between sentences in discourse, in particular the insights that have found their way into formal theories of discourse interpretation such as DRT and SDRT. These theories model the effects of a number of properties of utterances on the inference of such relations, in particular: the textual order of utterances, tense and aspectual class of the sentences, the structure of the lexical entries of certain words (lexical knowledge), as well as domain knowledge associated with certain concepts. At the same time, I have discussed some examples where these knowledge sources appear to play no role, and nevertheless, very specific implicit discourse relations (*Reformulation*, *Explanation*) can be inferred. These data suggest that the role played by lexical and world knowledge in the inference of implicit relations might have to be reconsidered.

Further, I have recapitulated Asher and Lascarides’ (2003) proposal for the treatment of cases where an implicit discourse relation seems to be made explicit later in the text (“backward spreading” of discourse relations). Some empirical problems of Asher and Lascarides’ implementation of this mechanism were pointed out. In the next section I will come back to this issue and discuss some further problems that will become evident in the light of the SDRT analysis of the connective *and*.

As we have seen, many useful ideas on the inference of implicit discourse relations have been proposed and formalised, but there are some loose ends. At this point I will not draw any conclusions from the observed problems—all conclusions will be postponed till Section 2.5, by which time a more comprehensive picture of the strengths and weaknesses of the current theories of discourse interpretation will emerge.

2.3 The contribution of the conjunction *and*

This section recapitulates the current theoretical proposals that attempt to account for the behaviour of the intersentential conjunction *and*. According to some previous studies surveyed in Section 2.1, *and* can co-occur with a number of relational meanings that in our current terminology fall into the categories of *Narration*, *Result*, *Continuation*, *Parallel* and *Contrast*. Depending on the intonation pattern, *and* can also “express” a conditional relation, or *Consequence*. At the same time, it appears to be incompatible with the discourse relations

Elaboration, *Explanation*, *Background*, as well as the non-veridical relations *Alternation* and *Purpose*, cf. Table 2.1 on p. 33. To the best of my knowledge, there is no single theory that would capture all these observations. The analyses considered in this section concentrate primarily on the non-occurrence of *and* with *Elaboration* and *Explanation*.

First, a brief historical notice. In traditional descriptive grammars *and* is usually assigned a number of distinct temporal, resultative, adversative and other meanings which are intended to cover cases of *Narration*, *Result*, etc. In theoretical linguistics, however, a lot of effort has been made to get rid of this multiple ambiguity view of the semantics of *and*, by giving it a single abstract meaning, and deriving the temporal, resultative and other effects as the result of pragmatic inference of some sort. Most notably after Grice (1975), *and*'s semantics was argued to be equivalent to the logical conjunction ' \wedge ' (see Schmerling, 1975; Gazdar, 1978; Posner, 1980). One of the central arguments supporting this view was that all the temporal and other effects of *and* that go beyond logical conjunction are also found with asyndetic connection, so they cannot be specific to *and* as a lexical item. In the previous section, I reviewed a number of approaches to the inference of the temporal sequence effect, or *Narration*, on the basis of various sorts of information provided by the context. Inference strategies for other relations that occur in *and*-conjunctions can be found in the literature, see e.g. Asher and Lascarides (2003). Crucially, none of these inference mechanisms distinguish between sentences conjoined by *and* and their asyndetically connected counterparts, and apply to both of them to the same extent. Thus in accordance with the Gricean tradition, these theories capture the parallelism between conjunction and asyndetic connection, and do not have much to say about the differences between these two connection modes.

One of the first accounts of the semantic differences between *and*-conjunctions and juxtaposed sentences was proposed by Bar-Lev and Palacas (1980). They argued that *and* should be treated as distinct from the logical conjunction, and that its semantics should exclude that the content of the second conjunct is temporally or causally prior to that of the first. This approach, however, only predicts the non-occurrence of *and* with (certain cases of) *Explanation*. Other relations that appear to conflict with *and* remain unaccounted for.

Since Bar-Lev and Palacas (1980), the differences between conjoined and juxtaposed sentences have received a lot of attention from Relevance theorists, in particular Blakemore (1987), Carston (1993), Blakemore and Carston (1999, 2005), Carston (2002, Chapter 3); and recently, an SDRT-based analysis has been proposed by Txurruka (2003). Both approaches provide a more comprehensive account of the relevant phenomena, so they will be presented in more detail below. I will start with Txurruka's analysis in the framework of SDRT in Section 2.3.1, and then return to the ideas developed in Relevance Theory in Section 2.3.2.

2.3.1 *And* in SDRT

As pointed out above, SDRT inference mechanisms introduced in Section 2.2.4 apply both to paratactically juxtaposed and conjoined sentences. Thus the fragment of the theory presented so far predicts an *Explanation* relation in discourses like (124) and (125) regardless of the presence or absence of the conjunction *and*. This is unsatisfactory, since the (b) versions of these examples

are intuitively not *Explanations*.

- (124) a. Max fell. John pushed him.
b. Max fell, *and* John pushed him.
- (125) a. Susan cried. John hit her.
b. Susan cried, *and* John hit her.

Section 2.1.3 also cited some data that suggest that *and* is incompatible with *Elaboration* and *Background*, cf. Table 2.1 on p. 33. Txurruka’s (2003) theory captures these facts by stipulating that *and* signals a *coordinating* discourse relation, and is incompatible with *subordinating* relations. Since *Elaboration*, *Explanation* and *Background* are subordinating, they are always blocked by *and*.

The distinction between coordinating and subordinating discourse relations is fundamental, not just in SDRT, but also in other theories of discourse structure.⁴⁵ It plays a crucial role in the construction of the discourse graph, determining which nodes are accessible for the attachment of new material. For instance, if discourse constituents α and β are connected by a coordinating discourse relation and the next sentence γ is to be attached to this discourse, it can only be attached to the last constituent β . By contrast, if β is subordinated to α then both of them are accessible, and γ can be attached to either.⁴⁶ Within discourse graphs constructed in accordance with these constraints, subordinating and coordinating relations impose further restrictions on the accessibility of antecedents for anaphoric expressions: for example, if γ contains an anaphoric pronoun and is attached to β which in turn is coordinated with α , the pronoun can only “see” potential antecedents in β , but not in α (cf. Asher and Lascarides, 2003, p. 146–159). Furthermore, coordination and subordination impose different constraints on the construction of the discourse topic. The topic of a sequence of coordinated discourse units is their strongest common abstract (as outlined for *Narration* in Section 2.1.3, pp. 17–18). Topics in subordination constructions work differently (see e.g. Asher and Lascarides, 2003, p. 227 on topics for *Elaboration*). In other words, the distinction between coordinating and subordinating discourse relations is independently motivated by a number of linguistic phenomena.

The question which relations are coordinating and which subordinating is not completely settled (see Asher and Vieu (2005) for discussion). However, there are more clear and less clear cases. For instance, *Elaboration* and *Explanation* are uncontroversially subordinating, whereas *Narration* is coordinating. The lists of coordinating and subordinating relations assumed by Txurruka are given in (126) and (127), respectively.⁴⁷

⁴⁵The SDRT concept of coordinating vs. subordinating distinction is inspired by the work of Polanyi (1988). The roughly equivalent notions in Rhetorical Structure Theory (RST Mann and Thompson, 1988) are *multinuclear* and *nucleus-satellite* relations. Grosz and Sidner (1986) distinguish between *satisfaction-precedence* and *dominance*.

⁴⁶This is a consequence of the so-called *Right Frontier Principle* that stipulates that the only nodes accessible for attachment are those on the “right frontier” of the discourse graph. The right frontier consists of the last processed sentence and all the dominating (subordinating) nodes.

⁴⁷It should be noted that Asher and Lascarides (2003, pp. 165–168) treat *Background* as coordinating, but in many respects it works almost like a subordinating relation, in particular in terms of its influence on anaphoric accessibility. In RST, *Background* is clearly subordinating (nucleus-satellite).

(126) **List of Coordinators:**
Narration, Result, Parallel, Conditional, ...

(127) **List of Subordinators:**
Explanation, Instance, Background, Elaboration, Evidence,
Generalization, Reformulation, ...

Txurruka (2003) achieves the blocking of subordinating discourse relations by *and* via stipulating this in the glue logic in the form of the inference rule (128), as it would be translated to Asher and Lascarides' (2003) notation. Notice that (128) follows the same scheme as the inference rules for cue phrases that signal discourse relations explicitly, e.g. *but*, cf. (122) in Section 2.2.4, p. 55. The presence of *and* implies *indefeasibly* a coordinating relation. The only difference compared to other cue phrases is that *and* signals a whole class of discourse relations, rather than a single one.

(128) **And:**
 $?(α, β, λ) \wedge \text{and}(α, β) \rightarrow \text{Coordinator}(α, β, λ)$

Although in general SDRT allows for more than one discourse relation to hold for one and the same pair of SDRS-s, coordinating and subordinating relations are mutually exclusive:

(129) **Coordinators are incompatible with Subordinators:**
 $\text{Coordinator}(α, β, λ) \rightarrow \neg \text{Subordinator}(α, β, λ)$

These rules are all that is needed for blocking subordinating discourse relations in *and*-conjunctions. In cases like (125) where a subordinating discourse relation is inferred on the basis of supporting domain knowledge, the rule for *and* blocks this inference in the glue logic. Since the axiom schema for *Explanation* (108) is defeasible, and indefeasible information blocks conflicting defeasible information, a coordinating relation rather than *Explanation* is inferred in (125b). In (124) with no conjunction, *Explanation* is preferred by the MDC without recourse to the glue logic, since the lexical entry of *push* specifies a causal relation. However, if *Explanation* is established in the same way in (124b) where *and* is present, the rules (128) and (129) will produce an inconsistent SDRS, so the MDC will presumably disprefer it.

In general, Txurruka's analysis of *and* is similar to that of Bar-Lev and Palacas (1980) in that it departs from the idea of equivalence between the natural language conjunction *and* and the logical conjunction. The rule in (128) assigns *and* additional content, even though (unlike Bar-Lev and Palacas) this content is not semantic in the classical sense, but belongs to the level of discourse pragmatics. In the next section I will consider a relevance theoretic analysis which takes the opposite position on the issue concerning the logical conjunction.

2.3.2 *And* in Relevance Theory

This section presents the ideas on the function of the conjunction *and* developed by Diane Blakemore and Robyn Carston in the framework of Relevance Theory (Blakemore, 1987; Carston, 1993; Blakemore and Carston, 1999, 2005; Carston, 2002). One of their central arguments against a semantic analysis along the lines of Bar-Lev and Palacas (1980), which applies to Txurruka's (2003) account

as well, is that it “makes the constraint on the interpretation of conjunctions seem to be an entirely arbitrary matter: words encode certain concepts and that’s all there is to it”, as Carston (1993, p. 41) puts it. Carston proposes that the discourse-pragmatic contribution of *and* can and should receive further explanation.

The main positions of Relevance Theory, in which Blakemore and Carston’s explanation is embedded, are given in (130) and (131) as they were stated by Sperber and Wilson (1986, 1995, pp. 125, 158). The main idea is that all implicatures or other effects of an utterance that go beyond its conventional meaning are a consequence of optimising its relevance in the current context, which is achieved by maximising its “contextual effects” and minimising the processing effort.

(130) *Relevance:*

Extent condition 1: an assumption is relevant in a context to the extent that its contextual effects in this context are large.

Extent condition 2: an assumption is relevant in a context to the extent that the effort required to process it in this context is small.

(131) *Principle of relevance:*

Every act of ostensive communication communicates a presumption of its own optimal relevance.

Against this background, Blakemore and Carston propose to trace back the effects of *and* to its structural (syntactic) properties, and thus to its role in determining the boundaries of utterances as relevant processing units, whereas its conventional truth-conditional semantics remains equivalent to the logical conjunction.

[...] An *and*-conjunction constitutes a single utterance or speech act, and so carries the presumption of optimal relevance as a whole, while the juxtaposed clauses constitute two processing units, two speech acts, each carrying the presumption individually. (Carston, 1993, p. 42)

According to Blakemore and Carston, the exclusion of *Explanation* and *Elaboration* interpretations for the second conjunct of an *and*-conjunction follows automatically. They seem to assume that *Explanation* and *Elaboration* interpretations of the second sentence/utterance are possible only if it answers an (implicit) question raised by the first. In the case of *Explanation* this question is *why?* or *how come?*, for *Elaboration* the question can be more or less anything—e.g. a *who?*, a *what?*, or a *where?* question—as long as it demands more specific information with regard to the content of the first utterance. But the processing of the *and*-conjunction as a single pragmatic unit rules out the interpretation of the first conjunct as an independent unit which can raise implicit questions, hence the *Explanation* and *Elaboration* interpretations are ruled out for the second conjunct.

I will not try to reconstruct all of Blakemore and Carston’s argumentation or evaluate their assumptions. In any case, their proposal to derive the pragmatic differences between conjoined and juxtaposed sentences from the syntactic differences between the two connection modes is worth noting. If this idea could be

formally implemented, it would certainly present a more explanatory alternative to Txurruka’s (2003) proposal.

2.3.3 Discussion

In the previous two sections I have recapitulated two rather different theoretical proposals intended to account for the non-occurrence of intersentential *and* with such discourse relations as *Elaboration*, *Explanation* and *Background*. In this section I will discuss some features of these proposals that can be viewed as problematic. Since Blakemore and Carston’s proposal lacks formal implementation, discussing its predictions would require too much interpretation, which would go too far beyond the scope of the current study. Therefore, I will concentrate primarily on Txurruka’s (2003) predictions.

Discourse relations vs. semantic relations

One of the aspects of Txurruka’s theory that leaves you with a feeling of dissatisfaction is the way it treats the relationship between discourse relations (*Explanation*, *Elaboration*, etc.) and their semantic correlates (causal, part-whole relations between eventualities). In Section 2.1.3, pp. 27–29, I cited some examples that show that even if *and* precludes a particular discourse relation, it does not necessarily preclude its semantic consequences. That is, $\neg \textit{Explanation}(\alpha, \beta, \lambda)$ does not necessarily entail $\neg \textit{cause}(\beta, \alpha)$. By taking a closer look at the relevant examples, it appears that there are a number of clearly identifiable linguistic properties of the utterances that determine whether or not a backwards-causal interpretation of the conjunction is available. In (132a) with a “neutral” intonation pattern a backwards-causal reading is indeed impossible. However, if the second clause is phrased with a cleft construction as in (132b), or if the clauses are realised with fall-rise intonation and additional prominence on some constituents, as in (132c), cf. Carston (2002, p. 252), then a backwards-causal interpretation is at least possible, and in fact quite readily accessible. There is also a further difference between (132b) and (132c). In (132c) the speaker seems to be deliberately not committing him- or herself to the statement that John broke the vase, which produces a slightly humorous effect: two facts that are so obviously connected are presented as if they had nothing to do with each other. By contrast, (132b) if uttered with unmarked intonation seems to make a much clearer statement of John’s guilt.

- (132) a. The vase broke *and* John dropped it.
b. The vase broke *and* it was John who dropped it.
c. Well | the VASE BROKE | *and* JOHN dropped it |

A complete theory of intersentential semantic relations should capture the differences between these examples. Txurruka (2003) does not mention cases like (132b), but briefly discusses cases like (132a) and (132c), however, her account raises a number of questions.

On the one hand, Txurruka seems to assume that the failure to infer *Explanation* precludes a temporal reversal and hence a backwards-causal relationship between the events, or in other words, $\neg \textit{Explanation}(\alpha, \beta, \lambda)$ implies $\neg e_\beta \prec e_\alpha$ and $\neg \textit{cause}(e_\beta, e_\alpha)$ (Txurruka, 2003, p. 268–269, 270–271). Suppose it is so.

Unfortunately, Txurruka does not state explicitly at which level of representation this inference should be drawn. Two possibilities come to mind: inference axioms of the glue logic, and the meaning postulates for discourse relations in the logic of information content. Whichever level we take, an SDRS that contains $\neg\textit{Explanation}(\alpha, \beta, \lambda)$ could then only be embedded in a model where the main eventuality of β *did not precede* and *did not cause* the main eventuality of α . On the other hand, when discussing examples like (132c), Txurruka suggests that $\neg\textit{Explanation}(\alpha, \beta, \lambda)$ is inferred in the usual way but “the speaker is not asking the hearer” to infer a reversed temporal interpretation. The fall-rise intonation pattern is interpreted as (a) ‘what I am asserting is all I know for a fact’ and (b) ‘you are encouraged to draw implicatures taking as premises what I said.’ The temporal reversal interpretation is then drawn out as an “implicature”—a separate level of representation that does not form part of the discourse representation structure (Txurruka, 2003, pp. 278–279). However, on the face of it, this kind of “implicature” would then be inconsistent with the truth conditions of the corresponding SDRS and could not be maintained. Thus on this interpretation, Txurruka’s proposal is too strong after all, as it would exclude a reversed temporal and causal reading for all three examples in (132).

Of course, one might wonder whether going from $\neg\textit{Explanation}(\alpha, \beta, \lambda)$ to $\neg e_\beta \prec e_\alpha$ and $\neg\textit{cause}(e_\beta, e_\alpha)$ is in fact a valid inference in SDRT. Strictly speaking, what Txurruka’s theory predicts for the discourses in (132) is that the discourse relation between the conjoined clauses is coordinating (not subordinating), i.e. *Narration*, or *Result*, or *Continuation*, or *Parallel*, or *Contrast*, etc. If *Narration* or *Result* is inferred, then temporal reversal and a backwards-causal relation are indeed excluded by the meaning postulates. However, *Continuation*, *Parallel*, and *Contrast* do not impose any constraints on the temporal or causal relations. This means that $\neg\textit{Explanation}(\alpha, \beta, \lambda)$ or even $\neg\textit{Subordinator}(\alpha, \beta, \lambda)$ does not automatically allow you to conclude $\neg e_\beta \prec e_\alpha$ or $\neg\textit{cause}(e_\beta, e_\alpha)$. If this is right, then Txurruka’s theory turns out to be too weak, since it does not exclude a backwards-causal relation for (132a).

In order to capture the different truth-conditional consequences of the examples in (132) in the SDRT framework, what one would need, it seems, is a mechanism that would infer *Narration* or *Result* in (132a), but *Continuation*, *Parallel*, or *Contrast* in (132b) and (132c). Txurruka does not provide such a mechanism,⁴⁸ but a solution along these lines should be possible. However, this solution would still say nothing about the difference between (132b) and (132c). First of all, how should this difference be characterised formally? One possibility is this: in (132c), it seems indeed plausible that, as Txurruka suggests, the speaker is not asking the hearer to interpret the discourse as an *Explanation*. It is questionable, however, whether this applies to (132b). Thus one might want to analyse (132b), in contrast to (132c), as an instance of *Explanation*, cf. e.g. Asher and Vieu (2005, p. 599). But in that case, Txurruka’s theory is too strong again since it *indefeasibly* excludes *Explanation* in *and*-conjunctions, cf. (128), repeated in (133).

⁴⁸It should be emphasized that the inference of *Narration* discussed by Txurruka on pp. 268–269 crucially makes use of the inference step from $\neg\textit{Subordinator}(\alpha, \beta, \lambda)$ to $\neg e_\beta \prec e_\alpha$. If this step is invalid, then the whole inference cannot be maintained. Txurruka does not provide any *other* mechanism for the inference of *Narration* in examples like (132a).

(133) **And (Txurruka, 2003):**

$$?(\alpha, \beta, \lambda) \wedge \mathit{and}(\alpha, \beta) \rightarrow \mathit{Coordinator}(\alpha, \beta, \lambda)$$

Asher and Vieu (2005, p. 599) suggest that one possible solution to this problem could be to make the rule for *and* defeasible, i.e. infer a coordinating relation by default in all three cases in (132), but introduce an additional rule (perhaps, triggered by the cleft construction) to cancel this default in (132b). This solution is certainly technically viable, but one should keep in mind the consequences it would have for the overall architecture of the theory. Recall that Txurruka’s rule for *and* (128) is designed to cancel the default inferences of *Explanation*, *Elaboration*, *Particularisation*, *Generalisation*, etc., cf. Section 2.2.4. The corresponding axiom schemata are repeated below.

(134) **Explanation:**

$$[(\alpha, \beta, \lambda) \wedge \mathit{cause}_D(\beta, \alpha) \wedge \mathit{Aspect}(\alpha, \beta)] > \mathit{Explanation}(\alpha, \beta, \lambda)$$

(135) **Particularisation:**

$$[(\alpha, \beta, \lambda) \wedge \mathit{subtype}_D(\beta, \alpha) \wedge \mathit{Aspect}(\alpha, \beta)] > \mathit{Particularisation}(\alpha, \beta, \lambda)$$

(136) **Generalisation:**

$$[(\alpha, \beta, \lambda) \wedge \mathit{subtype}_D(\alpha, \beta) \wedge \mathit{Aspect}(\alpha, \beta)] > \mathit{Generalisation}(\alpha, \beta, \lambda)$$

(137) **Elaboration (proper):**

$$[(\alpha, \beta, \lambda) \wedge \mathit{preparatory-phase}_D(\beta, \alpha) \wedge \mathit{Aspect}(\alpha, \beta)] > \mathit{Elaboration}(\alpha, \beta, \lambda)$$

There are two ways in which one rule can override the effect of another (defeasible) rule in the glue logic: either the first rule is indefeasible, or its antecedent is more specific than that of the second rule so the “Penguin” Principle (91) can be applied, cf. p. 45. By making the rule for *and* indefeasible, Txurruka chose the first strategy. However, if the rule is made defeasible, we are forced to take the second strategy, in which case it would not be enough to simply replace “ \rightarrow ” by “ $>$ ” in (133). We would have to make sure that the antecedent of such a rule is more specific than that of each of the rules in (134)–(137), which would only be possible if we introduced four rules for *and* whose antecedents repeat those of (134)–(137), respectively, but contain an additional conjunct *and*(α, β). One such rule is given in (138)—the one for overriding *Explanation* (134).

(138) **And overriding Explanation:**

$$[(\alpha, \beta, \lambda) \wedge \mathit{cause}_D(\beta, \alpha) \wedge \mathit{Aspect}(\alpha, \beta) \wedge \mathit{and}(\alpha, \beta)] > \mathit{Coordinator}(\alpha, \beta, \lambda)$$

Furthermore, it turns out that even more distinct rules for *and* would be needed if we unpack the content of the *Aspect*(α, β) conjunct in the antecedents of (134)–(137). Recall that *Aspect*(α, β) encodes the idea that the inference of *Explanation*, *Elaboration*, etc. is unaffected by the aspectual class. Strictly speaking, *Aspect*(α, β) is an informal abbreviation to having four rules that take into account all possible combinations of α and β presenting an event or a state (Asher and Lascarides, 2003, p. 206):

(139) **Explanation I–IV:**

- a. $[?(\alpha, \beta, \lambda) \wedge \textit{cause}_D(\beta, \alpha) \wedge \textit{event}(\alpha) \wedge \textit{event}(\beta)] > \textit{Explanation}(\alpha, \beta)$
- b. $[?(\alpha, \beta, \lambda) \wedge \textit{cause}_D(\beta, \alpha) \wedge \textit{event}(\alpha) \wedge \textit{state}(\beta)] > \textit{Explanation}(\alpha, \beta)$
- c. $[?(\alpha, \beta, \lambda) \wedge \textit{cause}_D(\beta, \alpha) \wedge \textit{state}(\alpha) \wedge \textit{event}(\beta)] > \textit{Explanation}(\alpha, \beta)$
- d. $[?(\alpha, \beta, \lambda) \wedge \textit{cause}_D(\beta, \alpha) \wedge \textit{state}(\alpha) \wedge \textit{state}(\beta)] > \textit{Explanation}(\alpha, \beta)$

The explicit mention of the aspectual classes in the form of these four rules is necessary for the same reason—to override the default inferences of certain discourse relations that are triggered by aspectual information (see Asher and Lascarides, 2003, p. 207). This means that the four axiom schemata in (134)–(137) turn into sixteen, and the overriding rules for *and* multiply accordingly! It should be emphasised that the resulting sixteen rules for *and* could not be summarised into one by e.g. forming a disjunction of all the antecedents, since such a disjunction would be neither more nor less specific than the antecedents of the axiom schemata for *Explanation*, *Elaboration*, etc., and that would result in a clash by the Nixon Diamond (92), p. 45, and no relation could be established at all.

This example shows that cascading defaults in SDRT can lead to an artificial proliferation of inference rules. It would certainly be possible to construct an empirically accurate theory with these formal tools. However, such a theory would not increase our understanding of the functioning of *and* in discourse. Effectively, we would end up listing the individual cases. In this respect, Txurruka’s decision to treat *and* as an indefeasible cue sheds more light on the matter as it stays in line with the idea that information that is explicitly encoded by a lexical item is “stronger” than (i.e. can override) the information that is communicated implicitly regardless of the relative specificity of those pieces of information.

To summarise, Txurruka’s theory of *and* excludes a number of discourse relations between conjoined sentences, but the predictions regarding the semantic consequences of such exclusion are not clear. As examples like (132) show, the influence of *and* on the semantic relations is not so straightforward and is sensitive to a number of additional linguistic factors that have not yet received a proper analysis. On the other hand, the correction suggested by Asher and Vieu using defaults that would leave space for those additional factors and at the same time make the relationship between discourse relations and semantic relations more straightforward, comes at the cost of enormously increasing the number of stipulations. It should be noticed, however, that Blakemore and Carston’s (informal) relevance theoretic account does not go further than Txurruka’s in this respect. Their analysis stops at the point of excluding ‘explanatory’ and ‘elaborative’ links between utterances, and does not go much further in teasing apart the cases in which this does or does not have truth-conditional consequences. But we are certainly not satisfied until the link to the truth conditions—causal and temporal relations between described eventualities—is established, since causal and temporal effects are after all one of the main motivations for discourse relations as a linguistically relevant theoretical construct. In other words, a satisfactory theory of the influence of *and* on the causal and temporal relations in discourse is not yet available.

Salience/Accessibility in *and*-conjunctions

There is also another way in which *and* could affect the truth conditions and coherence of a discourse within Txurruka's analysis. As pointed out in Section 2.3.1, the distinction between coordinating and subordinating discourse relations is essential for the construction of the discourse graph and imposes constraints on the salience/accessibility of antecedents to anaphoric expressions. Thus if Txurruka's theory is right and the conjunction *and* specifies the type of discourse relation as coordinating, then it should also produce the corresponding effects on the availability of attachment sites and on anaphora resolution. If the SDRT theory of referent accessibility is taken literally, the prediction would be that an antecedent mentioned in the first conjoined clause cannot be coherently referred to by a pronoun in subsequent sentences. Txurruka (2003) does not discuss the related consequences of her theory, and it seems that a systematic empirical study has not yet been carried out.⁴⁹ However, it is easy to find counterexamples. For instance, Asher and Vieu (2005, p. 605) point out that the discourse in (140) is coherent although the pronoun *she* in (140d) refers to the antecedent *Lea* in (140a), which is inaccessible if (140b) is connected to it by a coordinating discourse relation, triggered by *and*.

- (140) a. Lea screamed,
b. *and* so the burglar ran away
c. but Max woke up.
d. *She* also got a sore throat.

Another systematic exception is *and*-parentheticals (cf. Wichmann, 2001; Blakemore, 2005). Parentheticals often constitute *Commentaries* (Asher, 2000, p. 34), but *Commentary* is a subordinating discourse relation (Asher and Vieu, 2005, p. 601). The content of a *Commentary* is set off the main story line and is less salient than the surrounding text, thus it can easily be "skipped" in search for pronoun antecedents,⁵⁰ as illustrated by (141), where *he* in (141c) refers to *John* in (141a). However, if *and* forces a coordinating discourse relation then (141a) should be inaccessible from (141c), the antecedents for the pronoun *he* would have to be searched for in (141b), and since there is no appropriate one, the discourse is predicted to be incoherent.

- (141) a. *John* borrowed money from Mary
b. (*and* she is a good friend of mine)
c. but *he* does not seem to be going to return it.

These counterexamples show that the SDRT analysis of *and* does not make the right predictions regarding discourse coherence. There are again two ways to save the situation. One possibility is that *and* is made a defeasible cue that triggers a coordinating discourse relation by default, whereas this default is overridden somehow in examples like (140) and (141); however, this approach leads to the inference rule proliferation discussed earlier. The other possibility:

⁴⁹Though see the work by Fabricius-Hansen and colleagues for some relevant cross-linguistic observations (e.g. Ramm and Fabricius-Hansen, 2005; Behrens and Fabricius-Hansen, 2005).

⁵⁰Indirect evidence for this claim can be found in empirical studies in the Centering framework. For instance, Poesio et al. (2004, p. 38) find that fewer coherence violations are computed for a corpus if parentheticals are not treated as separate utterances, but as part of the utterances in which they are embedded.

the relationship between discourse coordination/subordination and anaphora has to be rethought.⁵¹ This would probably be a productive line of research, though it should be kept in mind that the (more or less direct) influence of the coordination/subordination distinction on anaphora resolution is one of Asher and Lascarides' (2003) main arguments for introducing discourse relations. If this relationship has to be loosened, Asher and Lascarides' argumentation is in danger of being undermined.

The role of *and* in lists

Finally, I would like to discuss some effects of *and* that have received no attention in previous accounts. These effects, as such, do not falsify Txurruka's theory, but present an additional problem to Asher and Lascarides' (2003) approach to "backward spreading" of discourse relations discussed in Section 2.2.4, pp. 54–55. In Section 2.1.3, pp. 19–20, it was pointed out that intuitively (143a) is somewhat less coherent than (143b) at least if it is understood as a complete answer to the question *What did Kim do today?*, i.e. there is no continuation—the speaker just says (143a) and stops.

(142) What did Kim do today?

- (143) a. ? Kim watched TV. She studied.
 b. Kim watched TV *and* (she) studied.

Asher and Lascarides (2003) explain the somewhat suboptimal character of (143a) by the lack of explicit cues that would help the hearer make a final decision on the discourse relation that holds between the two sentences. The inference of a discourse relation is delayed until further disambiguating input, as in (144).

(144) Kim watched TV. She studied. *Then* she went out.

However, if the intuition illustrated in (143) is correct, then the coherence of (143b) *vis-à-vis* (143a) is puzzling. Arguably, *and* in (143b) does not disambiguate the discourse relation. According to Txurruka (2003), it constrains the choice of a discourse relation, but that does not seem to bring much in the case of (143). First of all, the semantic relation between the conjoined clauses in (143b) seems to be rather weak: the speaker is simply listing Kim's activities today, which need not have taken place in the order of presentation, that is, (143b) is compatible with *Narration*, but it is also compatible with *Parallel*, or *Continuation*, or even *Contrast* (studying and watching TV are quite opposite in many respects). Is this variety of alternatives enough to trigger the inference delay? If so, then (143b) should be just as incoherent as (143a). If not (one might argue that all these relations are mutually compatible, so the hearer might infer all four at once), then the question is whether (143a) leaves more alternatives open than (143b) does. For instance, if *Elaboration* or *Explanation* were the alternative discourse relations considered for (143a) then the difference in acceptability could be explained: in (143a) the hearer has a "real" choice between incompatible discourse relations, as opposed to (143b). However, it is questionable whether *Elaboration* and *Explanation* constitute *real* alternatives to *Narration/Continuation/Parallel/Contrast* in (143a). Given general world

⁵¹ Apparently, this is the alternative Txurruka (2003, cf. p. 265) had in mind.

knowledge assumptions, both *Elaboration* and *Explanation* are quite implausible in (143a): studying can hardly be identical with or part of watching TV, and it is unlikely that studying causes, or explains, or provides evidence for watching TV. On the contrary, when you study, you normally *don't* watch TV. Thus if relations like *Elaboration* and *Explanation* are ruled out in this way, then the discourse relation options in (143a) and (143b) are the same, so the discourses should be equally coherent or incoherent. In other words, the greater coherence of (143b) cannot be due to (143b) being less ambiguous than (143a).

Another example that perhaps makes the same point more evident is (146).

(145) What did Mary say in the project meeting?

(146) a. # Mary criticised John. She praised him.

b. Mary criticised John *and* she praised him.

On the basis of lexical and world knowledge, an *Elaboration* or *Explanation* relation in (146) is out of question, even more so than in the previous example. Only relations like *Narration*, *Continuation*, and *Contrast* could be considered for both (146a) and (146b). If Asher and Lascarides' explanation based on the discourse relation being unresolved were correct, (146a) should be at least as felicitous as (143a), or even more felicitous. In fact, it is worse.⁵² Thus I conclude that it is not the lack of information that is responsible for the infelicity of (143a) and (146a).

It is also unclear whether the presence of an overt cue plays a role in explaining the greater felicity of (144). Compare (144) and (147). Just like (144), (147) is more coherent than (143a). However, this cannot be due to disambiguation of the discourse relation for the same reasons. *And* in (147) does not provide more information on the discourse relation than there has been already.

(147) Kim watched TV. She studied. *And* she went out.

At the same time, some sort of "backward spreading" is at work in (147), too. Obviously, it is enough to only use the conjunction in the last sentence in order to conjoin all three and make the whole sequence more felicitous. However, this process must be rather more structural in nature: what *and* does in (147) is make a complete list out of an incomplete one, and whatever relation *and* imposes, is established between all the elements of the list. The semantics of this relation obviously plays little role for coherence.

There remains one big question. If it is not insufficient information for the inference of a discourse relation that is responsible for the infelicity of (143a) and (146a), then what is it? My guess is the same as in connection with the problematic examples discussed in Section 2.2.4: asyndetic connection creates a strong bias for an *Elaboration/Explanation* interpretation (in the absence of explicit cues signalling other relations in the sense of Section 2.1.1). This *Elaboration/Explanation* bias conflicts with the world knowledge in (143a) and (146a), which explains their infelicity. In other words, I regard these examples as another potential piece of evidence for the existence of this bias.

⁵²Note that the incoherence of (146a) cannot be due to a complete failure to infer a discourse relation. As (146b) shows, at least *Narration* or *Continuation* are possible, and there is no mechanism to prevent the inference of these relations in (146a), if they can be inferred in (146b).

2.3.4 Summary

This section presented two approaches to the analysis of the distinction in discourse semantic effects between asyndetic connection and *and*-conjunction—Txurruka’s proposal in the framework of SDRT and Blakemore and Carston’s Relevance theoretic analysis. These theories primarily address the observations summarised in the upper part of Table 2.1, p. 33, providing a reasonably good coverage of it. However, two problems have been pointed out.

First, these proposals go as far as excluding “elaborative” and “explanatory” links between conjoined clauses, but the relevant specification of these notions is unclear. If they are operationalised in the sense of SDRT’s discourse relations *Elaboration* and *Explanation*, i.e. their truth-conditional consequences and effects on discourse coherence, then the predictions of the theory are not borne out. That is, it is not clear that the presence of *and* imposes restrictions on the semantic relations between reported eventualities or on anaphora resolution. If it does impose any such restrictions, the conditions under which this happens are at least not sufficiently understood yet.

On the other hand, in this and the previous section I pointed out some examples that suggest that the asyndetic connection rather than the *and*-conjunction imposes some non-trivial constraints on the inference of implicit discourse relations. In particular, I proposed some tentative arguments for a bias towards *Elaboration/Explanation*. Although this bias has previously been noted by Carston (1993, 2002), in my opinion it has received too little emphasis, and has not been appropriately dealt with in formal approaches to discourse semantics such as SDRT. This is the second problem.

The next section briefly addresses the lower part of Table 2.1, i.e. the non-occurrence of non-veridical relations with either mode of implicit connection, as well as the non-occurrence of concessive relations between asyndetically connected sentences. I will argue that these observations, too, suggest a more restrictive theory for the interpretation of asyndetic connection.

2.4 A note on relations that cannot remain implicit

For the sake of completeness, in this section I will make some remarks on the previous studies that address the observations summarised in the lower part of Table 2.1, p. 33. That is, we seek an answer to the questions why certain relations cannot remain implicit, in particular, why the ‘denial of expectation’ type of *Contrast* cannot be inferred between two juxtaposed independent sentences in the absence of a conjunction, and why the non-veridical relations *Alternation* and *Purpose* are impossible with both modes of implicit connection, as well as with conditional relations (depending on the intonation pattern), cf. Section 2.1.4. Interestingly, however, these questions have received very little attention in the literature so far, one of the reasons being, perhaps, that the answer seems too obvious.

Indeed, consider for example *Alternation* (disjunction). It seems too obvious why (148b) and (148c) cannot be understood as (148a). In the case of (148b) one could simply answer: because *und* is not *oder*, and *and* is not *or*. In the case of asyndetic connection in (148c) the argument could go as follows: by uttering the

two sentences (as independent) the speaker commits him- or herself to the truth of both sentences. Thus (148c) entails at least the logical conjunction of the sentences, whereas (148a) does not have this entailment. The same explanation would apply to other non-veridical relations, the result being: if you want to communicate a relation between two sentences that does not entail the logical conjunction, signal it.

- (148) a. Fritz muss gestern verreist gewesen sein.
Oder er hat den Termin einfach vergessen.
 b. Fritz muss gestern verreist gewesen sein.
Und er hat den Termin einfach vergessen.
 c. Fritz muss gestern verreist gewesen sein.
 Er hat den Termin einfach vergessen.

However, this argument only goes through in a pragmatic theory that only allows for strengthening of the conventional meaning, but not for weakening. Most neo-Gricean approaches have this feature, but neither Relevance Theory nor SDRT does. Of course, as such this is not a disadvantage of these theories, since many pragmatic phenomena, e.g. metaphor, cannot be reduced to strengthening alone (see e.g. Carston, 2004). However, in the domain of relational meanings such as the discourse relations in the SDRT sense, strengthening appears in fact to be the only permitted direction for pragmatic modification of the conventional meaning.⁵³ Since Relevance Theory and SDRT do not exclude weakening *per se*, they would need a more elaborate argument to make this prediction.

To the best of my knowledge, at least in SDRT, such an argument has not been proposed yet. Given the current state of the theory, nothing prevents one from introducing an axiom schema of the form in (149) which could (by default) infer a non-veridical relation between juxtaposed independent sentences, as well as between conjoined sentences, if the appropriate conditions are met (e.g. if it is supported by world knowledge).⁵⁴

- (149) $[?(\alpha, \beta, \lambda) \wedge \text{[some stuff unrelated to the mode of connection]}] >$
 $\textit{Alternation}(\alpha, \beta, \lambda)$

Of course, one could make the theory capture the facts correctly by simply not introducing such a rule. However, that would again look arbitrary. It does not give us an explanation why non-veridical relations must be signalled

⁵³An exception are the so-called divergent discourse relations like *Correction*, which involve downdate of previously updated material and which are not considered in this study. As far as *Consequence* (conditional) is concerned, it is not a *real* exception. As I tried to argue in Section 2.1.4, the apparent weaking of a conjunction to a conditional in the presence of modal operators can probably be explained away as weakening at intrasentential level triggered by those operators, whereas the relation between sentences only undergoes strengthening, e.g. along the lines of Txurruka (2003, pp. 279–281).

⁵⁴For example, (i) is a fictive, but perfectly reasonable rule for inferring *Alternation* (disjunction), which says that *Alternation* holds by default between α and β , if β is inconsistent with α (in other words, a conjunction would be inconsistent). A similar rule is in fact used by Asher and Lascarides (2003, pp. 351–352) to infer *Correction*.

- (i) $[?(\alpha, \beta, \lambda) \wedge (K_\beta \Rightarrow \neg K_\alpha)] > \textit{Alternation}(\alpha, \beta, \lambda)$

However, for some reason natural language does not work this way, and *Alternation* cannot be triggered just by inconsistency. An explanatory theory of discourse interpretation should explain this fact.

explicitly. In other words, what looked so obvious at first glance, does not look obvious at all from the point of view of the current theories of discourse interpretation.

As far as the non-occurrence of asyndetic connection with the ‘denial of expectation’ type of *Contrast* is concerned, an explanation is less obvious to begin with. In this connection it is useful to recall Carston’s (2002, p. 236) example (110) on p. 53, repeated below.

- (150) a. Max can’t read *and* he’s a linguist
b. Max can’t read. He’s a linguist

The main observation is: although the denial of expectation reading is strongly supported by world knowledge here, it is impossible with asyndetic connection, i.e. (150b) is either perceived as contradictory, or as an *Explanation* with a humorous effect. This could be another consequence of the *Elaboration/Explanation* bias associated with asyndetic connection. Concession is generally incompatible with *Elaboration* and *Explanation* at the level of truth conditions. Thus if asyndetically connected sentences are generally preferentially interpreted as *Elaborations* and *Explanations*, the non-inference of concession would be a natural consequence.

However, even if the *Elaboration/Explanation* bias plays a role here, the bias itself needs to be explained. I will return to this issue in Section XY. At this point it is important to note that neither Asher and Lascarides (2003) nor Txurruka (2003) provide an explanation to the non-occurrence of the ‘denial of expectation’ contrast between asyndetically connected sentences.

2.5 General discussion

In this chapter, I have reviewed the current state of research on implicit discourse relations, concentrating on the most common empirical assumptions made in the discourse semantics and pragmatics literature (Section 2.1) and the formal analyses thereof (Sections 2.2 and 2.3). A number of empirical and theoretical problems were pointed out. In my opinion, these problems point to two major conclusions.

The first conclusion is rather general and concerns the explanatory adequacy of the existing (formal) theories. It is my impression that so far the theoretical research has concentrated too much on the question how implicit intersentential relations are inferred, somewhat neglecting its natural counterpart: why sometimes a particular relation *cannot* be inferred (or is more difficult to infer). As a result, the proposed theories turn out to be too powerful and too flexible. In particular, SDRT integrates a variety of knowledge sources that can be used for the inference—world knowledge, lexical relations, as well as explicit cue phrases—however, it does not provide a general explanation why in some cases a particular knowledge source is used and the appropriate relation is inferred successfully, whereas in other cases the same inference does not go through although the same relevant knowledge seems to be available. This critique has been substantiated by three cases: (a) the prohibition of implicit realisation of non-veridical relations; (b) the prohibition of implicit concessive relations between asyndetically connected sentences; (c) the apparent prohibition of certain relations between sentences connected by *and*. Although SDRT

can provide an empirically accurate account of these observations, it does not explain them. This means that a more restrictive and more explanatory formal theory of implicit intersentential relations is needed.

The second (tentative) conclusion concerns specifically the empirical generalisation regarding the interpretive differences between asyndetic connection and the conjunction *and*. The mainstream view (summarised in Table 2.1, p. 33) has been so far that asyndetic connection does not impose any constraints on the inference of implicit relations, and that naturally, it leaves space for more interpretation possibilities than *and* or any other connective does. I am questioning this view. In particular, I propose that asyndetic connection creates a strong bias towards an *Elaboration* or *Explanation* reading. This bias can be overridden by explicit cues signalling other relations (e.g. *then*, *nevertheless*), but it is not so easily overridden by conflicting lexical or world knowledge.

The proposed generalisation has two aspects. First, it implies that whenever an *Elaboration/Explanation* interpretation is consistent with world knowledge, it is preferred, as *Elaboration* in (151a) and (152a), even if other interpretations are possible, cf. (151b) and (152b).

- (151) a. Fred damaged a garment. He stained a shirt.
b. Fred damaged a garment *and* (he) stained a shirt.

- (152) a. I met a great actress at the party; I met Vanessa Redgrave.
b. I met a great actress at the party *and* I met Vanessa Redgrave.

I have argued that the standard SDRT analysis undergenerates inferences to *Elaboration*, since it assumes that *Elaboration* must be *triggered*, e.g. by “lexical parallelism” based on synonymy, hyponymy/hyperonymy and coreference relations between the constituents of the sentences. However, it appears that a synonymy relation can be the new information conveyed by such a discourse, as is the case in (153), i.e. establishing synonymy of *anacrusis* and *unaccented note which is not part of the first full bar* is a consequence rather than cause of establishing *Elaboration*.

- (153) At the beginning of this piece there is an example of an anacrusis.
It begins with an unaccented note which is not part of the first full bar.

If these intuitions are correct, it shows that *Elaboration* must be established more or less by default, without recourse to lexical relations.

The second aspect of the proposed generalisation concerns the cases where the *Elaboration/Explanation* bias conflicts with world knowledge, i.e. if the second sentence cannot be plausibly understood as a description of (a part of) the eventuality introduced by the first sentence, or as a cause, reason or motivation for that eventuality, or as evidence for the proposition stated by the first sentence. I have argued that the *Elaboration/Explanation* bias is not so easily overridden by conflicting world knowledge, and that this conflict is responsible for marginal incoherence effects, as in (154a) and (155a), and for the contradiction effect in more severe cases like (156a) and (157a).

- (154) a. ? I drank coffee after lunch. I couldn't sleep the whole night.
b. I drank coffee after lunch *and* I couldn't sleep the whole night.

	Asyndetic connection	Conjunction <i>and</i>
Narration	*	✓
Continuation	*	✓
Parallel	*	✓
Elaboration & Co	✓	*
Explanation & Co	✓	*
Contrast (concession)	*	✓
Consequence	*	*/✓
Alternation	*	*
Purpose	*	*

Table 2.2: Implicit realisation patterns of SDRT discourse relations. Legend: ✓ / * indicates that the given discourse relation can / cannot be inferred with the given mode of implicit connection.

- (155) A: What did Kim do today?
 B: a. ? Kim watched TV. She studied.
 b. Kim watched TV *and* (she) studied.
- (156) A: What did Mary say in the project meeting?
 B: a. # Mary criticised John. She praised him.
 b. Mary criticised John *and* (she) praised him.
- (157) a. ?? Max can't read. He's a linguist
 b. Max can't read *and* he's a linguist

Thus in its strongest and most categorical version, the proposed empirical generalisation is represented in Table 2.2. In words, the only intersentential relations that can be inferred between asyndetically connected sentences in the absence of overt cues are *Elaboration* and *Explanation*.⁵⁵ At first glance this statement appears simply wrong. What about all those examples presented in Section 2.1.3 where juxtaposed independent sentences are connected by an implicit *Continuation* relation, *Parallel*, or *Narration*? The most obvious counterexample is *Narration* in discourses like (158) that the pragmatics literature abounds in.

- (158) The lone ranger jumped on his horse. He rode into the sunset.

In the next chapter I am going to argue that the class of data that so far has figured under the label of 'asyndetic connection' is in fact a heterogeneous class. More specifically, there is a subclass for which the generalisation in Table 2.2 can perhaps be maintained. However, delineating this subclass would require a systematic consideration of a number of additional factors. Some of these factors have already been mentioned occasionally, for instance, whether a sequence of sentences functions as an answer to a question or not, whether it is a complete "discourse" or there is a continuation. Another factor that is most crucial but has been ignored so far, is prosody and intonation. All these issues will be taken up in full detail in the next chapter.

⁵⁵The relations of *Result*, 'formal' *Contrast*, and *Background* are ignored in Table 2.2 for reasons that will be explained in Chapter 3.

The last remark concerning the results achieved in this chapter: I have tried to show that the apparent constraints on the inference of implicit discourse relations imposed by the use of the conjunction *and* are not yet well understood and are difficult to pin down in terms of truth-conditional effects and effects on discourse coherence. Therefore, these properties of *and* will be ignored in the rest of this study. When talking about the interpretive differences between asyndetic connection and *and*-conjunction, I will take the liberty and shift emphasis from the latter to the former. The focus of this thesis will be on the question why asyndetic connection excludes certain interpretations, rather than why *and* does. I believe that the proper understanding of *and*'s behaviour might depend on the answer to this more fundamental question.

Chapter 3

Discourse relations and prosody

The earlier work on discourse pragmatics reviewed in the previous chapter has usually assumed that asyndetic connection of sentences imposes weaker (if any) constraints on discourse meaning than any explicit discourse marker does. I have questioned this view by reconsidering some of the data discussed in the literature. In particular, I have put forward the hypothesis that under certain conditions asyndetic connection creates a bias for the inference of *Elaboration* or *Explanation*. This idea will be developed further in this chapter. The conditions under which this bias is expected to arise will be spelled out. I will argue that in addition to some contextual factors, a major role in distinguishing the relevant usages of asyndetic connection might be played by prosody, especially the utterance final “continuation rises” and “completion falls.”

Thus the main purpose of this chapter is to formulate in more detail the hypothesis concerning the restrictions on the inference of discourse relations associated with the asyndetic connection, and to illustrate it by examples. This is done in Section 3.1. The subsequent sections play a subordinate role. Section 3.2 discusses the results of some previous empirical studies that have a bearing on the proposed hypothesis. Although those results cannot be viewed as direct evidence, they do encourage pursuing the idea in both empirical and theoretical work. Section 3.3 presents some more detailed clarifications on the nature of the prosodic parameters that are expected to have an impact on discourse relations—the difference between “continuation” and “completion” intonation is illustrated with reference to Russian.

3.1 Asyndetic connection \neq asyndetic connection

The purpose of this section is to tease apart a number of distinct usages of asyndetic connection which correlate with different sets of implicit discourse relations. The hypothesis under investigation is that the range of implicit discourse relations that can be drawn between adjacent asyndetically connected utterances U_1 and U_2 depends on the following factors:

- (159) a. whether or not U_1 and U_2 form a (complete) discourse constituent;
 b. whether or not U_1 and U_2 pertain to the same question under discussion;
 c. whether or not both U_1 and U_2 are intonationally realised as complete answers to a question.

If the answer to all the three questions is “yes” then only *Explanation* and a subset of the varieties of *Elaboration* can be successfully inferred in the absence of overt cues, thus if the content of U_1 and U_2 does not support an *Explanation* or an *Elaboration* reading, then the discourse is not optimally coherent (cf. Table 2.2, p. 72).

Of course, the empirical assessability of this hypothesis depends crucially on how we draw the distinction between complete and incomplete discourse constituents and non-constituents, as well as between utterances pertaining to the same or to different questions under discussion. All these are rather involved theoretical issues, and the best solution would be to have a number of formal tests based on observable features of the utterances and/or their context which would supply the answers to the questions in (159). Due to the complexity of this task, it will not be possible to accomplish it fully here. However, I will develop a preliminary set of heuristics which, taken together, will help approximate the class of relevant cases.

Another important issue that contributes to the empirical assessment of the current hypothesis is what we take to be the intonational characteristics of complete answers to questions. The most important feature is, of course, the pitch shape of the nucleus of the (last) intonational phrase. In this section I will use such pretheoretical terms as “completion fall” (\searrow) vs. “continuation rise” (\nearrow) to refer to the relevant distinction, appealing at this point to the readers’ intuitions. The phonetic reality of these notions and the phonological categories that could stand behind them will be considered in the later sections.

Finally, it should be noted that the aim of this section is only to formulate and to give an intuitive illustration to the proposed hypothesis, which will be done by presenting some informal observations from English based mainly on introspection rather than a systematic empirical study. Some relevant results of previous empirical research that provide indirect support for the current hypothesis will be discussed in Section 3.2, whereas gathering conclusive evidence will have to be left altogether outside the scope of the current study as a task for future investigations.

This section is structured as follows. Section 3.1.1 briefly introduces the approach to discourse structure based on questions under discussion, and defines the related heuristics on utterance pairs that should help assess the hypothesis under investigation. Section 3.1.2 introduces some further heuristics that are based on the explicit linguistic and prosodic markers of discourse constituency known from previous research. Finally, Section 3.1.3 discusses the role of prosodic signalling of complete answerhood vs. various kinds of incompleteness, and illustrates the related consequences for the inference of implicit discourse relations.

3.1.1 Questions under discussion and discourse constituency

The QUD approach to discourse structure

The so-called *Question under Discussion* (QUD) approach is a collection of ideas and theories developed e.g. by Klein and von Stutterheim (1987, 1992), von Stutterheim and Klein (1989), van Kuppevelt (1995a,b), Roberts (1996), Ginzburg (1996a,b), Larsson (2002), Buring (2003), whose main assumption is that each utterance in discourse addresses a topic, that is, answers an explicit or implicit question (under discussion). If the question is actually uttered by one of the conversation participants, it is *explicit*, and *implicit* otherwise. A question Q can be satisfactorily answered by a single utterance, alternatively, it is split up into an array of subquestions $\langle Q_1, \dots, Q_n \rangle$, such that answering all the questions in $\langle Q_1, \dots, Q_n \rangle$ provides an answer to Q . That array is called *strategy* for answering Q , and the questions that constitute that array are *subquestions* of Q . The hierarchical discourse structure is determined by the hierarchical organisation of questions (topics) into subquestions (subtopics). Processing such a structure is usually thought of in terms of updating and downdating a stack. When a question is asked explicitly or implicitly it is pushed on the stack, its subquestions are pushed on top; the question on top of the stack is the one to be currently addressed; once it is answered it is popped off the stack so that its dominating question becomes available; the next subquestion of the strategy can then be processed. One of the central constraints on discourse coherence is defined in terms of QUD management: a question is not dropped until it is satisfactorily answered or acknowledged to be practically unanswerable. This prevents uncontrolled switching between unrelated issues.

In the QUD approach the relations between utterances are construed as relations between the underlying questions. This contrasts with the assumptions made in other frameworks such as RST or SDRT, where discourse relations connect the utterances directly. Discourse topics similar to QUDs are also employed in SDRT, but their role is much more limited (see esp. Asher, 2004). They are important in connection with certain discourse relations, e.g. *Narration*, *Parallel*, *Contrast*, cf. Chapter 2, pp. 17–19. However, they do not serve as the main organising principle of discourse structure, and in most cases, identifying the topic is not needed for the inference of discourse relations. This reserved position makes sense in view of our poor understanding of how to infer discourse topics, especially in cases when they are not introduced by an explicit question. The concept of implicit QUDs is subject to largely the same criticisms as those put forward by Asher and Lascarides (2003, pp. 76–78, 87) against Grice, Searle, Relevance Theory, Neo-Griceans and Grosz and Sidner (1986): making the inference of discourse relations entirely dependent on the underlying speaker’s intentions, goals and other ‘private’ features of the participants’ cognitive states (e.g. implicit QUDs) introduces unnecessary conceptual and computational complexity into the model.

These problematic issues will be put aside for the moment and will not be taken up again until Chapter 7. The heuristics for mapping discourses to QUD structures proposed below will provide a temporary work-around.

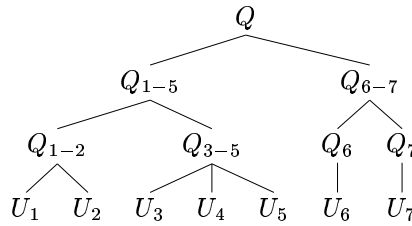


Figure 3.1: Schematic QUD structure for a sequence of declarative utterances $\langle U_1, \dots, U_7 \rangle$ produced by one speaker. The non-terminal nodes of the tree are labelled with questions under discussion Q_{1-2} , Q_{3-5} , Q_6 , Q_7 , Q_{1-5} , Q_{6-7} , and Q .

Definitions

For the purposes of this investigation I will assume a notion of QUD structure which is close to Klein and von Stutterheim’s and Büring’s proposals. A *QUD structure* will be defined as a constituent tree consisting of a (finite) set of terminal nodes $\{U_1, \dots, U_n\}$, called *utterances*, a (finite) set of non-terminal nodes $\{Q_1, \dots, Q_m\}$, called *questions under discussion*, or *QUD-s*. I assume a standard definition of a constituent tree (e.g. Partee et al., 1990, pp. 439–446) with a nodes ordered by *precedence* (strict partial order) and *dominance* (weak partial order). The relation of *immediate dominance* is defined in the usual way: node A *immediately dominates* node B iff A dominates B , and there is no node C distinct from both A and B , such that A dominates C and C dominates B . An example of a QUD structure is given in Figure 3.1. Note that there is no restriction to binary branching: both multiply branching nodes, e.g. Q_{3-5} , and non-branching nodes, e.g. Q_6 , are allowed.

There is a mapping between utterances and sets of possible worlds (propositions), and between non-terminal question nodes and partitions of sets of possible worlds. Thus the terminal nodes of a QUD structure are associated with semantic objects of the same type as the meanings of declarative sentences, whereas the non-terminal nodes are associated with objects of the same type as the meanings of interrogative sentences within an approach to interrogative semantics such as that proposed by Groenendijk and Stokhof (1984).¹ The constraints concerning which question may dominate which other question or utterance in a QUD structure are defined in terms of the relationships between

¹Groenendijk and Stokhof’s view of interrogative semantics is as a partition of the set of possible worlds where the individual cells of the partition correspond to mutually exclusive *exhaustive* answers to the question. One of its most prominent alternatives is the approach where interrogatives denote sets of mutually compatible non-exhaustive answers, originally due to Hamblin (1973). There might be reasons to prefer Hamblin-style questions for the semantic analysis of interrogative sentences, however, this controversy is irrelevant for the current discussion. The semantic objects associated with the question nodes of the QUD structure are not meanings of interrogative sentences, and in principle, they need not be objects of the same type as such meanings. It is useful that semantic interpretations of interrogatives can be *mapped* in a systematic way on the semantic objects associated with the non-terminal nodes of a QUD structure, which is possible from Hamblin-style to Groenendijk and Stokhof-style questions. Thus I will keep assuming that questions under discussions correspond to Groenendijk and Stokhof’s partitions without having to commit to either approach to the semantic analysis of interrogative sentences.

	Pertain to the same QUD	Form a discourse constituent
$\langle U_1, U_2 \rangle$	yes	yes
$\langle U_3, U_4 \rangle$	yes	no
$\langle U_6, U_7 \rangle$	no	yes
$\langle U_5, U_6 \rangle$	no	no

Table 3.1: Examples of pairs of adjacent utterances in the QUD structure shown in Figure 3.1 with different combinations of values for the local pertinence condition and the discourse constituency condition

the corresponding semantic objects. These constraints are based on the notions of answerhood, relevance, subquestion and strategy along the lines of Roberts’ (1996) and Büring’s (2003) proposals. Some of these notions will be discussed in more detail in Chapter 6, Section 6.4.1. For the present purposes, the details of the mapping and the constraints are irrelevant.

Finally, a *discourse constituent* is defined as a constituent of such a QUD structure, i.e. a sequence of utterances $\langle U_1, \dots, U_k \rangle$ such that there is a node Q that dominates all of $\langle U_1, \dots, U_k \rangle$ and does not dominate any other utterances. For instance, $\langle U_1, U_2 \rangle$, $\langle U_3, U_4, U_5 \rangle$, $\langle U_1, \dots, U_5 \rangle$ are discourse constituents in the QUD structure in Figure 3.1, whereas $\langle U_5, U_6 \rangle$, $\langle U_1, U_2, U_3 \rangle$, $\langle U_2, \dots, U_7 \rangle$ are not. The notion of “pertaining to a question” can also be defined in terms of the dominance relation between utterances and QUDs. In a broad sense, an utterance U can be understood as *pertaining* to question Q iff it is dominated by Q . In this sense, all the utterances of a well-formed QUD structure pertain to the same question, namely the one that constitutes the root node of that tree. However, a more useful notion is that of *local pertinence*: an utterance U *locally pertains* to question Q iff it is *immediately dominated* by Q . For instance in Figure 3.1, U_1 and U_2 locally pertain to the same question under discussion, just like U_3, U_4 and U_5 do; but this is not the case with e.g. U_5 and U_6 , or U_6 and U_7 . The term “pertain to a question” will be used in this more narrow sense in the discussion below, unless explicitly noted otherwise. It is in this sense that this notion was intended to be understood in the formulation of the hypothesis under investigation here, cf. (159).

Thus we have defined the notions of discourse constituent and “pertaining to the same question under discussion” which are necessary for understanding the first two of the three premises of our hypothesis. Notice that a sequence of two adjacent utterances can freely combine the values of these features. The four possible combinations are exemplified in Table 3.1. Thus the $\langle U_1, U_2 \rangle$ sequence in Figure 3.1 satisfies both conditions— U_1 and U_2 both pertain to the same question Q_{1-2} and form a discourse constituent; $\langle U_3, U_4 \rangle$ do pertain to the same question Q_{3-5} , but they do not form a constituent, since Q_{3-5} also dominates U_5 , i.e. only the whole sequence $\langle U_3, U_4, U_5 \rangle$ forms a complete constituent; $\langle U_6, U_7 \rangle$ in turn do form a constituent, which is dominated by the node Q_{6-7} , however, the utterances are not immediately dominated by Q_{6-7} —*locally* they pertain to distinct questions Q_6 and Q_7 ; finally, $\langle U_5, U_6 \rangle$ is a case that violates both conditions. Obviously, only cases like $\langle U_1, U_2 \rangle$ are relevant for validating the current hypothesis.

Mapping instances of discourse to QUD structures

In order to make efficient use of the above definitions, ideally, one would like to be able to establish a mapping between real or constructed discourses and QUD structures. Such a mapping would presumably consist of two major components: (a) rules for segmenting the flow of discourse into utterances; and (b) a grammar to parse sequences of utterances to obtain discourse trees of the appropriate form. Providing a general solution to this problem is a task far too ambitious to undertake in the present study, therefore, I will confine myself to defining a number of heuristics that help identify discourse fragments with the relevant type of structure (the $\langle U_1, U_2 \rangle$ type, cf. Figure 3.1 and Table 3.1).

Identifying utterances: Thus the first question is how to construct an utterance or identify one in the flow of discourse. For the time being, let's assume that a sentence that is not embedded in another sentence and forms one or more full intonational phrases, corresponds to an utterance.² Taking this as a preliminary definition one will certainly miss lots of cases that one might want to consider an utterance, especially in spoken spontaneous discourse which usually contains lots of disfluencies and where full well-formed sentences occur rather rarely. Indeed, this notion of utterance will be extended later in this section to cover some non-sentential cases, however, it will be used as a starting point in the current wording.

Identifying answers to the same question: Next, given a pair of adjacent (declarative) utterances in the above sense, how do we know whether they pertain to some question under discussion,³ and if they do, whether it is the same question? Note that for answering the latter question it might be useful to be able to identify the question under discussion that a particular utterance pertains to. Since there is as yet no generally applicable, principled and reliable way of identifying implicit questions under discussion, only utterances that immediately follow an explicit question (by a different speaker) will be considered. A general scheme for such a discourse (fragment) is shown in (160): U_Q is an interrogative utterance produced by speaker A , whereas U_1 and U_2 are declarative utterances produced by speaker B immediately afterwards.

(160) A: U_Q
B: $U_1 U_2$

Before discussing the possible structures for discourses like (160), one should exclude some obvious cases where the utterances that follow a question do not

²I assume a standard notion of intonational phrase, according to which intonational phrases are identified on the basis of their internal tonal structure on the one hand, and a bundle of prosodic features marking intonational phrase boundaries on the other. From the point of view of internal structure, an intonational phrase must consist of one or more intermediate phrases (Beckman and Pierrehumbert, 1986) which, glossing over theory-internal specifics, boils down to the requirement of at least one pitch accent per intonational phrase. The prosodic features that play a role in identifying intonational phrase boundaries include pause, final lengthening, acceleration on anacrustic syllables, as well as the occurrence of boundary tones (see e.g. Cruttenden, 1997, pp. 29–34).

³Recall Asher's (2004) reservations, according to which discourse topics (or questions under discussion) might be relevant for determining the structure of only some but not all discourse constituents.

answer it in the strict sense. First, a question might not be *accepted* by the addressee for a variety of reasons, one of them being a *grounding failure*, i.e. if the addressee has reasons to believe that (s)he has not sufficiently understood what the speaker meant (on the notion of *grounding* see e.g. Clark and Schaefer, 1993). Most importantly, as Ginzburg (1996a, p. 232) points out, “whenever a conversationalist fails to believe she has been provided with the full information needed to ground the utterance, she should *actively signal* this” (my emphasis). This can be done by using a number of particles, such as *eh*, *come again* and *what*, or a clarification request as in *B*’s response in: *A: Did Bo finagle a raise? B: Finagle?* (Ginzburg and Cooper, 2004, p. 299). Thus, if any such marker follows the question utterance U_Q , the question will be assumed to be rejected, so that the subsequent utterances do not answer U_Q . Second, if a question is accepted, it can be immediately dismissed if no information on that question can be provided (cf. Ginzburg, 1996a, p. 228). This is usually indicated by such responses as *I don’t know*, which will not be viewed as answers to U_Q either.

If a question asked by speaker *A* is not rejected or immediately dismissed in one of the above mentioned ways, the following declarative utterances (U_1, U_2) of speaker *B* are assumed to contribute to a direct answer to U_Q , if they are both *congruent* with U_Q . The idea behind the notion of question-answer congruence as developed by von Stechow (1991), Roberts (1996), and Büring (2003) is that the answer has the appropriate *form*, i.e. is *uttered* in a way appropriate to the form of the question. (That is, congruence is a relationship determined primarily by the form rather than the content of U_Q and U_1/U_2 .)

The central role in defining congruence is played by the syntactic structure and the information structure of the interrogative and the answer. The first assumption is that some syntactic constituent(s) of an interrogative sentence are marked with an “interrogative” feature: the *wh*-phrases in *wh*-questions and the syntactic equivalent of polarity in *yes/no*-questions. Second, some constituent(s) of a declarative sentence is/are assumed to be *focused*, or F-marked.⁴ The focused constituent must contain a focal pitch accent, which is characterised by its nuclear prominence, i.e. it is the most prominent pitch accent in the intonational phrase,⁵ and a certain type of pitch movement distinguishing focal accents from e.g. topic accents in the current context.⁶ The position of the nuclear accent within the focused constituent is determined by a set of rules sensitive to the syntactic structure and contextual givenness (see e.g. Selkirk, 1995; Schwarzschild, 1999). In other words, the accentual pattern of an utterance constrains the possible F-markings within the corresponding sentence

⁴Corresponds roughly to Schwarzschild’s (1999) FOC-marking.

⁵It is usually assumed that the last pitch accent of an intonational phrase has this property (see e.g. Beckman and Pierrehumbert, 1986).

⁶It has been proposed for English that falling accents mark focus, whereas fall-rises mark contrastive topic (see e.g. Büring, 2003). However, it probably does not make much sense to distinguish topic and focus accents in such an absolute, context-independent way. For instance, if an utterance as a whole is marked as “non-final” its focused constituent can bear a rising pitch accent instead of a fall. The distinction between topic and focus constituents in such utterances can be based on other prosodic and non-prosodic features. For example, whereas it is generally typical for Russian to mark topics with rises and foci with falls, Kodzasov (1996b, p. 198) points out that in *yes/no*-questions the pattern can be reversed: the focus (rheme) bears a rising, and the topic (theme) a falling accent. Thus I will generally assume that focus constituents can be distinguished from topic constituents of the basis of their prosodic or other formal features, although the exact nature of the relevant distinctions in different contexts remains largely an open question.

in a non-trivial way.

Given these assumptions, a declarative utterance U is congruent with an interrogative utterance U_Q , roughly, if U minus its focused constituents equals U_Q minus its “interrogative”-marked constituents,⁷ where “equals” is not to be understood as identical word for word, but rather as broadly synonymous. This synonymy relationship can be characterised as the semantic equivalence of the open propositions derived by abstracting over, but preserving the sortal restrictions for the focused/*wh*-phrase (e.g. animate vs. inanimate for *who* vs. *what*). The current notion of question-answer congruence is thus based on the same principles as that of von Stechow (1991), Roberts (1996), and Büring (2003). In what follows, this notion will be illustrated for some major types of interrogatives, paying special attention to non-sentential answers and “broad-focus” interrogatives such as *What happened?* that have previously received comparatively little attention in the discussion of congruence. It is possible that the formal definitions given by Roberts (1996) and Büring (2003) will have to be amended to accommodate some of the cases discussed below. I will not attempt any such amendments, but assume that this can be done using largely the same formal machinery.

A congruent answer to a *yes/no*-question is either *yes*, or *no*, or a modal operator of epistemic probability like *maybe*, *probably*, etc., cf. (161a). An utterance of a declarative sentence that is obtained from the interrogative by undoing the interrogative syntax is a congruent answer if it has narrow focus on the polarity (verum focus), as in (161c).⁸ The answer may contain some contextually determined replacements like *you/we*, replacements with a synonym, as well as anaphoric expressions and ellipsis resolved by the interrogative utterance, e.g. *do/don't* in (161b). An example of an incongruent reply to a *yes/no*-question is given in (162) (Ward and Hirschberg, 1985).⁹

- (161) A: Do you accept credit cards?
B: a. Yes/No/Maybe/Probably/...
b. We do/don't.
c. We DO/DON'T/do NOT accept credit cards.

- (162) A: Do you accept credit cards?
B: Visa and Mastercard.

A congruent answer to a constituent question can be a single constituent that agrees with the *wh*-phrase in a number of features, e.g. case, animacy, etc. (depending on the language and the type of interrogative phrase), e.g. (163a) and (164a). Congruent sentential answers are obtained from the interrogatives by largely the same formal operations as in the case of *yes/no*-questions, plus replacing the *wh*-phrase with an appropriate non-*wh* constituent and putting narrow focus on it, cf. (163b), (163c), (164b). Note that synonymous constructions may assign a different grammatical role to the constituent that corresponds

⁷F-marked constituents of the interrogative sentence that are not “interrogative”-marked are irrelevant for the current notion of congruence.

⁸In English verum focus is typically signalled by the presence and nuclear accentuation of the auxiliary verb. It is equivalent to nuclear accentuation of the finite verb in languages like German and Russian. In negative answers, it is the nuclear accentuation of the negative particle, or the phonological word to which it attaches as a clitic.

⁹Words bearing focal and topic accents are marked by small caps. Accent marking, as well as F-marking, is suppressed in short answers.

to the *wh*-phrase, as in (164c), but focus must stay on *that* constituent.

- (163) A: Who came to the party?
B: a. John/John and Mary/Two friends/Every linguist/...
b. [JOHN]_F did.
c. [JOHN]_F came to the party.
- (164) A: Who did Bill invite to the party?
B: a. John/John and Mary/Two friends/Every linguist/...
b. He invited [JOHN]_F (to the party).
c. [JOHN]_F was invited.

Similarly, a congruent answer to a multiple *wh*-question is either an array of constituents with appropriate categories corresponding to each *wh*-phrase (165a), or an utterance of a declarative sentence with multiple foci (165b). Note that both *John* and *Mary* in (165b) must bear a focal accent. If, for instance, *John* were marked as a contrastive topic instead (CT, following Büring, 2003), then under the current notion of congruence, it would be congruent with the question *Who did John hit?* rather than *Who hit whom?*, cf. (166).

- (165) A: Who hit whom?
B: a. John Mary
b. [JOHN]_F hit [MARY]_F
- (166) A: Who did John hit?
B: [JOHN]_{CT} hit [MARY]_F

Finally, “broad focus” questions like *What did X do (there and then)?*, *What happened (there and then)?*, *What is/was going on?*, etc. can license two types of congruent answers. Firstly, such questions can be treated as normal constituent questions like (163) and (164) above, which license constituent answers, e.g. (167a) and (168a), or sentential answers with narrow focus on the appropriate constituent, e.g. (168b). Secondly, sentential answers with broad focus on the VP for questions of the type *What did X do?*, *What is X like?*, or sentential answers with focus on the whole sentence for questions like *What happened?* also count as congruent. If the question concerns the VP, as in (167), the subject of the answer must be the same as or corefer with that of the question.

- (167) A: What did Kim do (today)?
B: a. Silly things/lots of interesting things/...
b. Kim did [lots of interesting THINGS]_F.
c. Kim/she [STUDIED]_F
- (168) A: What happened?
B: a. An accident/The worst/...
b. [An ACCIDENT]_F happened.
c. [John broke his LEG]_F

It should be noted that the generic verbs *do*, *happen*, etc., that are used in languages like English to form questions to a VP or a whole sentence, may impose restrictions on the semantics of the verbs in the answer, which are in a way similar to case/animacy/etc. agreement requirements between *wh*-words and constituent answers. For instance, in questions like *What did X do?* *X*

is an agent, which requires that X also be an agent in the answer, or can at least be interpreted as having a certain amount of control over the described situation:

- (169) A: What did Kim do?
B: a. Kim watched TV.
b. ?? Kim fell.

On the contrary, *happen* presupposes a certain lack of control from the participant expressed by the experiencer argument, as in (169), or an individual determined pragmatically in the given context.¹⁰

- (170) A: What happened to John?
B: a. He fell.
b. Max pushed him.
c. ?? He pushed Max.

Only answers that satisfy such “agreement” requirements will be viewed as congruent.¹¹

To sum up, congruence is a relation between interrogative and non-interrogative utterances defined in terms of a number of “replacement” operations on their syntactic form (rather than content) and focus structure, although the relationship between expressions eligible for replacement may sometimes be defined in semantic terms, as in the case of synonymy or semantic agreement.¹² Note also that the original notion of a declarative utterance is being extended to all sorts of congruent answers, including non-sentential answers formed by particles like *yes* and constituent answers like *John*, as long as they satisfy the intonational criterion, i.e. form one or more full intonational phrase.

As already mentioned, of all dialogue fragments of the form $\langle U_Q, U_1, U_2 \rangle$ in (160), only those will be considered where both U_1 and U_2 each on its own are congruent with U_Q . The dialogues (171) and (172) below satisfy this criterion, whereas (173) and (174) do not. In (173), only U_1 , but not U_2 is congruent with the question; in (174) it is neither U_1 nor U_2 . Notice that a congruent answer to *What languages do John and Bill speak?* must contain a reference to both John and Bill, i.e. have the general form *John and Bill speak XY*, whereas (174a) and (174b) only mention one of the two. Whether *John/Bill* bears an accent or not, and whether this is a topic or a focal accent, does not play a role in this case.

- (171) A: What did Kim do today?
B: a. Kim watched TV.
b. She studied.

¹⁰The answers listed under (a), (b), and (c), in (169) and (170) are meant as alternative possible one-utterance responses, rather than sequences of utterances forming a single conversation turn.

¹¹It might be more elegant to treat agreement as related to *relevance* rather than *congruence* of the answer. Thus the answer *A beautiful sunset* can be viewed as irrelevant (uninformative) with respect to the question *Who did you see yesterday?* since it only asks about the persons seen by the addressee, and not things or events. Similar argumentation can be applied to the “agreement” with *happen* and *do*. Subsuming these cases under the notion of congruence is a simplification for presentational purposes.

¹²Congruence is not to be confused with the notion of relevance which holds for answers that are informative of a question. Thus, the answer *Someone or no one* is a congruent answer to the question *Who came to the party?* although it is completely uninformative.

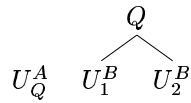


Figure 3.2: The default schematic QUD structure assigned to a sequence of declarative utterances U_1, U_2 uttered by speaker B following an interrogative utterance U_Q by speaker A .

- (172) A: What happened to John?
 B: a. He fell.
 b. Max pushed him.
- (173) A: What did John do?
 B: a. He walked into the room.
 b. The director was slumped in her chair.
- (174) A: What languages do John and Bill speak?
 B: a. JOHN speaks FRENCH.
 b. BILL speaks GERMAN.

Thus congruence is a condition that identifies pairs of utterances that have the right form to serve as direct answers to the same explicit question. This is a heuristic that helps filter out some difficult cases, but it does not yet guarantee that the utterances pertain to the same question under discussion in the sense of QUD structures introduced above. The difference and the remaining conditions will be clarified presently, after addressing the issue of discourse constituency.

Identifying discourse constituents: Obviously, the longer the sequence of utterances the more possibilities there are as to how they are grouped together to form discourse constituents. Therefore, our attention will be restricted to sequences of exactly two utterances in the answer, that is, after the production of U_2 the discourse just ends, or the turn is (non-competitively) taken by a different speaker.

Let's put the pieces together. Suppose U_Q is an interrogative utterance produced by speaker A , whereas U_1 and U_2 are declarative utterances congruent with U_Q produced by speaker B immediately afterwards, cf. (160). If after the production of U_2 the discourse just ends, or the turn is (non-competitively) taken again by a different speaker, then the "monologue" produced by B will be assumed *by default* to have the relevant type of structure shown in Figure 3.2, where U_1 and U_2 pertain to the same question under discussion and form a discourse constituent, thus satisfying the first two premises of the hypothesis in (159).¹³

Finally, let's briefly return to the role of congruence and the relationship between congruent responses to the same interrogative utterance, and responses pertaining to the same question under discussion. As Figure 3.2 is intended to suggest, a distinction is drawn between the interrogative utterance U_Q and the question under discussion Q that dominates the utterances of the answer. The

¹³There are still a number of exceptions to this default rule which will be considered in Section 3.1.2.

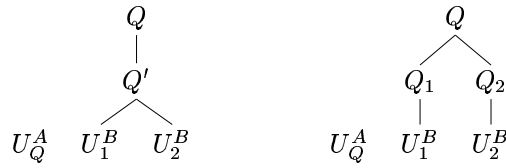


Figure 3.3: Possible alternative schematic QUD structures that can be assigned to a sequence of declarative utterances U_1, U_2 uttered by speaker B following an interrogative utterance U_Q by speaker A .

former corresponds to a specific fragment in the discourse flow (an utterance of an interrogative sentence) and maps to a terminal node of a discourse constituent tree within a broader notion of discourse constituency than the one developed here; the question under discussion Q , on the contrary, is a non-terminal node of the discourse tree which does not directly correspond to any such fragment.¹⁴ The congruence requirement is a way (or rather, the best attempt) to make sure that the relationship between U_Q and Q is reasonably straightforward—in the ideal case the partition of the set of possible worlds associated with Q equals the semantic interpretation of U_Q (or the corresponding partition, if we assume a Hamblin-style semantics of interrogatives).¹⁵ In this sense U_Q makes Q explicit. I follow Roberts (1996) and Büring (2003) in assuming that the incongruence of a response with the question utterance is an indication that the response pertains to a different question under discussion than the one associated with the partition denoted by the interrogative. The two questions under discussion might be related, e.g. by a subquestion relation, but the QUD structures one would assume in these cases (some options are shown in Figure 3.3) would be different from the reference standard in Figure 3.2. (The subscript Q in U_Q indicates that U_Q denotes the question partition associated with Q .) In other words, the congruence requirement is the best one can do to have a grip on the Q partition and to make sure that both U_1 and U_2 pertain to it.

To summarise, in this section I have defined the notions of discourse constituency and the “pertaining” relation between an utterance and a question under discussion that are necessary to assess the current hypothesis under investigation, cf. (159). Further, I have defined a number of heuristics that help construct pairs of utterances that form a discourse constituent and pertain to the same question under discussion, or identify appropriate fragments in the flow of discourse. The proposed conditions are in fact neither necessary nor sufficient for identifying relevant structures. In general, they are not necessary since they are based on a rather narrow *ad hoc* notion of a discourse constituent and restricted to cases of explicit questions under discussion. Of course, the hope is that once a more general characterisation of these parameters is developed, the set of relevant instances of discourse will become more inclusive and the current

¹⁴One could say perhaps that Q corresponds to a sequence of utterances that it dominates, in the same sense as a non-terminal node NP of a syntactic tree may correspond to the string “green ideas.” However, in that sense Q corresponds to a sequence of declarative utterances $\langle U_1, U_2 \rangle$ rather than the interrogative utterance $\langle U_Q \rangle$.

¹⁵More generally, the semantic interpretation of the interrogative in U_Q will constitute a constraint on Q .

hypothesis will be extendable to those cases. However, the related investigations go beyond the scope of this study.

On the other hand, the proposed heuristics are also not sufficient, since as was pointed out above, a number of exceptions still need to be excluded from the class of relevant discourse fragments. These exceptions are reviewed in the next section.

3.1.2 Linguistic markers of discontinuity

A considerable body of empirical work has shown that natural languages provide a range of explicit means to mark discourse structure. Such marking devices are not restricted to discourse relations (see Chapter 2), but are also available for other aspects of discourse structure, such as topic structure and abstract discourse constituency. In particular, there is a variety of means to mark *discontinuity* in discourse constituency—switches from one topic to another, from one narrative episode to another, etc. In terms of QUD structures introduced in the previous section, such switches can be interpreted as the lack of connection between utterances at the most local level of discourse structure. Thus, if the second utterance in the sequence $\langle U_1, U_2 \rangle$ contains a marker of discontinuity, this is an indication that U_1 and U_2 do not form a discourse constituent, or do not pertain to the same question under discussion, and therefore do not instantiate a QUD structure of the relevant type (cf. Figure 3.2), even if they do satisfy all the conditions proposed in the previous section. This section reviews some important classes of discontinuity markers.

Discourse markers

To begin with, there are lexical markers of discontinuity in discourse structure—particles and adverbials that are known to co-occur with major structural breaks. Most of them will already be excluded by our restriction to considering implicit discourse relations in *and*-conjunctions and asyndetic connections (cf. Chapter 2, Section 2.1.1), as well as by the question-answer congruence requirement introduced in the previous section. However, for the sake of completeness such markers are worth mentioning. For example, Schiffrin (1987) suggests that the marker *now* is used to signal switching from one subtopic to another, and the particle *well* can function as a marker of switching from a subtopic back to a main topic (Schiffrin, 1987, p. 113).¹⁶ If any such marker occurs in U_2 then the sequence $\langle U_1, U_2 \rangle$ will not be assumed to form a discourse constituent, so such cases are irrelevant for evaluating the present hypothesis.

Tense and aspect

Second, switches in tense and aspect are known to correlate with discourse structural shifts. The relevant effects of aspect have already been discussed in

¹⁶Interestingly, Schiffrin (1987, pp. 129-130) proposes that *and* as well as the asyndetic connection can also mark transitions to a new discourse segment, however, this happens if the other mode of connection has been established as the “textual norm.” That is, after a sequence of asyndetically connected utterances, an utterance starting with *and* can mark the beginning of a new segment, and *vice versa*. However, in sequences of only two utterances there is no space to establish a “textual norm” with respect to which *and* or ‘zero’ can mark discontinuity. Therefore these modes of connection will not be considered as discontinuity markers in the present context.

Chapter 2, Section 2.2.2. In narrative texts in particular, eventualities that are presented as punctual (perfective aspect) constitute the main story line, or the *foreground* of the story; durative eventualities (imperfective aspect) belong to the *background* (Hopper, 1979). These insights have been implemented in SDRT in the discourse relation of *Background* which is triggered precisely by shifts in aspectual class (Asher and Lascarides, 2003, pp. 207–208). Within a QUD based framework, Klein and von Steutterheim (1987, p. 181) have proposed that clauses that belong to the background do not directly address the “main quaestio” of the narrative. Translating this into the current terms, I will assume that “foreground” and “background” utterances always locally pertain to different questions under discussion. In other words, a switch in aspectual class between U_1 and U_2 is an indication that they are not immediately dominated by the same Q , and hence do not instantiate the QUD structure in Figure 3.2.

Further, breaks in narrative structure can also be indicated by switches in tense. For example, switches between past and historical present have been shown to correlate with transitions from one episode of the narrative to another (see Schiffrin, 1981; Wolfson, 1982; Fleischman, 1990; Chafe, 1994). In terms of QUD structures, tense shifts will be viewed as possible signals that U_1 and U_2 do not form a discourse constituent and/or do not pertain to the same question at the most local level.

In sum, of all utterance pairs that satisfy other criteria only those will be considered where both U_1 and U_2 present a state (durative eventuality) or both present an event (punctual eventuality), and either at least one of the utterances is tenseless (a non-sentential utterance, e.g. *John*), or the main verbs of the corresponding sentences have the same tense form.

Contrastive topic

As already mentioned, contrastive topics are CT-marked constituents and are realised with a special kind of accent—a topic accent—which distinguishes them from foci (cf. fn. 6 on p. 80). For the most typical uses of contrastive topics, such as (175), it already follows from congruence that the utterances cannot be construed as answers to the same question. One of the consequences of the congruence requirement is that U_1 and U_2 have the same, i.e. synonymous, *background*—the part of the sentence minus the focused constituent. Since contrastive topics are assumed to be part of the background, and since they normally do not corefer and are not synonymous in any other relevant way, the utterances that contain them cannot be congruent with the same interrogative. E.g. (175a) with the given CT- and F-marking is congruent with *Where was John looking (for the lost cat)?* and (175b) with *Where was Mary looking (for the lost cat)?*, and there is no way of doing better.¹⁷

¹⁷The utterances in (175) could be construed as congruent with the same question if the F-marking took scope over the CT-marking, i.e. if topic were part of the broad focus, as in (i). In this case, the common question could be a “broad focus” question such as *What was going on?*

- (i) c. [[JOHN]_{CT} was looking under the TABLE]_F
 d. [[MARY]_{CT} was looking in the GARDEN]_F

I will adopt a common assumption in *a priori* excluding this possibility. A CT-marked constituent cannot be part of an F-marked constituent. The presence of a contrastive topic is thus an indication that focus is not maximally broad.

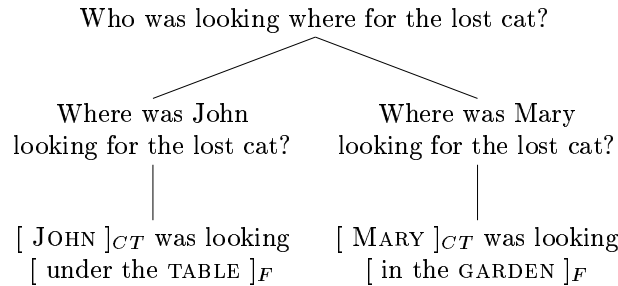


Figure 3.4: Büring’s (2003) style QUD structure for the discourse in (175).

- (175) a. [JOHN]_{CT} was looking [under the TABLE]_F
 b. [MARY]_{CT} was looking [in the GARDEN]_F

Following Büring (2003), discourses like (175) will be analysed as having a QUD structure like that in Figure 3.4.¹⁸ According to Büring’s proposal, contrastive topics make a contribution to congruence, too, but unlike foci, they do not determine the question under discussion that immediately dominates the utterance, but the question at the next more global level. Thus the contrastive topic on *John* in (175a) indicates that the immediate question under discussion *Where was John looking for the lost cat?* is part of a strategy to address the question *Who was looking where?*, and that other questions like *Where was Mary looking?* will also belong to that strategy and must be addressed if they haven’t yet.

In light of these considerations, it is interesting to note that constituents marked with a topic accent in two adjacent utterances may sometimes corefer. These can be construed as congruent answers to the same question according to the current notion of congruence, e.g. the question *What happened to John?* in the example below.¹⁹

- (176) A: What happened to John?
 B: a. [JOHN]_{CT} [broke his LEG]_F
 b. [HE]_{CT} [tripped on a Persian RUG]_F

However, mapping such discourse fragments to QUD structures of the preferred type, cf. Figure 3.2, is somewhat problematic. The contrastive topic accent on *John/he* indicates that the items are “contrasted” with something, and since they obviously cannot be contrasted with each other, this must be something in a broader context. In Büring’s terms, the question *What happened to whom?* must be at issue at a more global level. On the one hand, this question could have been previously established as an issue under discussion, for instance, if it was raised by speaker *A* immediately before, e.g. *A: What*

¹⁸In light of the current approach to QUD structures, the interrogative sentences labelling the non-terminal nodes of the tree in Figure 3.4 should be viewed as an informal representation for the semantic objects (partitions) associated with those nodes. This is different in Büring’s original proposal where overt interrogative utterances map to non-terminal nodes of the discourse tree, just like declaratives map to the terminal nodes.

¹⁹Cf. Blakemore and Carston’s (1999) example (60) discussed in Chapter 2, Section 2.1.3, p. 28.

happened to whom? What happened to John?, whereas speaker *B* only takes up the subordinate question, though marking its relationship to the more general question by using a contrastive topic. In this case nothing speaks against assigning the simple structure in Figure 3.2 to the interaction in (176). On the other hand, if the question *What happened to whom?* has not been previously established as a discussable issue, the apparently unmotivated usage of a contrastive topic in the answer can be interpreted as speaker *B*'s "proposal" to discuss it, cf. Zeevat (2004, p. 207). In this case one might be inclined to assume a more complex QUD structure for (176) than the one in Figure 3.2.

Similar and perhaps even greater difficulties are raised by discourses where only one of the utterances contains a contrastive topic:

- (177) A: What happened to John?
 B: a. [JOHN]_{CT} [broke his LEG]_F
 b. He [tripped on a Persian RUG]_F
- (178) A: What happened to John?
 B: a. John/He [broke his LEG]_F
 b. [HE]_{CT} [tripped on a Persian RUG]_F

Because of these potential problems, utterances with contrastive topics will not be considered as evidence for the current hypothesis. In other words, contrastive topic accents will be viewed as potential markers of discontinuity in the QUD structure regardless of whether they occur on coreferring or non-coreferring constituents. Although some usages of topic accents on coreferring constituents might ultimately be harmless, the tools for distinguishing these cases are not available in the absence of a more elaborate approach to mapping discourses to QUD structures in the current definition.

Global prosodic features

Finally, discontinuity in discourse structure can be signalled by global prosodic features of utterances. Global and local prosodic features differ in the size of their domain of application in the segmental string. Local prosodic events such as pitch accents and boundary tones, for instance, are anchored to single syllables, whereas global prosodic features—pitch range, pause duration, speech rate, and intensity—can characterise larger domains, e.g. whole intonational phrases or sequences of intonational phrases.²⁰ The features that are most uncontroversially acknowledged to be affected by discourse constituency are pitch range and pause duration.

Pitch range is a property of an intonational phrase and defines a subdivision of the total range of fundamental frequency variation of a given speaker. The pitch range can vary in width (e.g. expanded, normal, compressed) and in position relative to the total range (e.g. high, mid, low). It is the reference frame for local tonal events like pitch accents and boundary tones. This frame is usually characterised by two reference lines, the *top line* and the *base line*. The top line is the reference line for the realisation of high tones, and the base line for low tones. Especially the top line is strongly affected by pitch range manipulations. Thus for instance in a phrase with expanded pitch range the

²⁰E.g. the duration of a pause between two intonational phrases is a property of that pair of phrases.

top line is higher, and hence a high tone is realised higher than a high tone in a phrase with compressed pitch range.

Pitch range has been observed to undergo *global declination* across intonational phrases and utterances within a “spoken paragraph”, a discourse unit or a stretch of discourse pertaining to the same topic. Although the definitions of paragraphs, discourse units and topic units vary considerably across studies, the results are remarkably consistent, which suggests that objectively, there is some level (or levels) of discourse constituency to which all these notions can be mapped. Let’s call the relevant discourse unit a *discourse segment*. Thus it has been found that pitch range at the beginning of a discourse segment is expanded, and compressed in the end, see e.g. Grosz and Hirschberg (1992), Sluijter and Terken (1993), Swerts and Geluykens (1994, p. 31–33), Bruce et al. (2000). This leads to an effect called *pitch reset* or *declination reset* at discourse segment junctures—an abrupt expansion and upward shift of the pitch range.²¹ Some more recent studies have based their analysis on theoretically motivated elaborate notions of multilevel hierarchical discourse structure, e.g. Noordman et al. (1999) using Story Grammar and RST, den Ouden et al. (2000) and den Ouden (2004) using RST, Mayer (1999) and Möhler and Mayer (2002) using SDRT. They found that pitch range correlates with the depth of embedding of an utterance in the discourse tree: more deeply embedded utterances are realised with more compressed pitch range. Consequently, pitch reset is expected to occur at points of discourse pop—shift from an utterance that takes a lower position in the discourse tree to an utterance that has a higher position. Moreover, pitch reset has been shown to produce effects on discourse interpretation (e.g. anaphora resolution) that are expected at points of discourse pop (Silverman, 1987; Jasinskaja et al., 2005). All this suggests that pitch reset is a signal of discontinuity in discourse constituency. For the purposes of the present study I will assume that $\langle U_1, U_2 \rangle$ cannot form a single discourse constituent if pitch is reset in U_2 , that is, if U_2 is realised with a higher topline than U_1 , or more specifically, the highest pitch of U_2 is higher than the highest pitch of U_1 .

Similarly, pause duration is a rather well-studied correlate of discourse constituency. Longer pauses occur between more loosely connected discourse segments, whereas shorter pauses occur between utterances that are closely connected at more local structural levels (cf. Swerts, 1997; Mayer, 1999; den Ouden et al., 2000, among others). Thus if U_1 and U_2 form a discourse constituent the pause between them is expected to be relatively short, so if the pause is too long, this is a possible indication of discontinuity. However, it is difficult to operationalise this regularity for the current purposes. How long is “too long”? Note that a relative metric cannot be applied in this case. Because of the restriction to monologues consisting of only two utterances, there is no other pause with which the pause between U_1 and U_2 could reasonably be compared. Nevertheless, it is worth mentioning pauses as a possible discontinuity factor, especially if one should attempt to generalise the current hypothesis to pairs of utterances embedded in longer monologues.

To summarise, this section has presented four types of devices that can mark

²¹Moreover, Swerts (1997, pp. 518–519) found that the amount of pitch reset—the ratio by which the topline is raised as compared to the preceding intonational phrase—correlates with the boundary strength. Stronger boundaries separating less closely related discourse constituents cause a greater amount of reset.

discontinuity in discourse constituency: (a) certain lexical discourse markers; (b) shifts in tense and aspect; (c) contrastive topics; and (d) global pitch reset. Any of these devices can thus be an indication that the adjacent utterances U_1 and U_2 do not form a discourse constituent or do not pertain to the same question under discussion, and therefore do not exhibit the discourse structure in Figure 3.2. In what follows, only pairs of utterances will be considered where none of these discontinuity markers can be found.

3.1.3 Asyndetic connection under different intonation patterns

The previous two sections spelled out some heuristics that help either identify in the discourse flow or construct pairs of utterances that form a discourse constituent and pertain to the same question under discussion.²² Such utterance pairs thus satisfy the first two of the three premises of our hypothesis, repeated in (179) for convenience.

- (179) If the sequence of adjacent asyndetically connected utterances $\langle U_1, U_2 \rangle$ satisfies the following conditions:
- a. U_1 and U_2 form a (complete) discourse constituent;
 - b. U_1 and U_2 pertain to the same question under discussion;
 - c. U_1 and U_2 are intonationally realised as complete answers to a question;
- then only *Explanation* and a subset of the varieties of *Elaboration* can be inferred between U_1 and U_2 in the absence of overt cues, thus if the content of U_1 and U_2 does not support an *Explanation* or an *Elaboration* reading, then the discourse is not optimally coherent.

In this section I investigate the third premise (179c) and the consequences of this hypothesis. In particular, I will try to show that asyndetically connected utterances with different intonational patterns give rise to the inference of different sets of implicit discourse relations.

Intonation of continuation and completion

The crucial intonational opposition is that between *continuation* and *completion* tunes. I define a completion tune as one that is used to indicate a complete, exhaustive answer to a question, or a “closed” list of items. Accordingly, a continuation tune is a tune that serves to communicate that the speaker has not finished his or her utterance, i.e. the utterance (so far) is *not* a complete answer.²³ For example, (180) with a completion tune at the end indicates an exhaustive list of drinks, with a continuation tune it suggests that there may be other drinks available (cf. Cruttenden, 1981, pp. 79–80).

²²The proposed heuristics are intended as sufficient but not necessary conditions for identifying utterance pairs with the given properties.

²³Note that continuation tunes are not defined as those typically occurring on open lists. It has been found that at least some dialects have distinct tunes for continuation in lists and continuation in incomplete narratives, where the former do not impose a temporal order on the listed elements, whereas the latter do (see e.g. Gilles, 2005, pp. 140–141). However, these distinctions are irrelevant for the current purposes. Both kinds of tunes will count as continuation tunes.

(180) Gin, whisky, sherry, beer

Many languages signal the distinction between continuation and completion by intonational means, and the most widely spread pattern is that completion tunes are “falling,” whereas continuation tunes are “rising” (see Cruttenden, 1981, for detailed discussion). Languages may differ considerably in the alignment of the fall or the rise with the segmental string. The tune may, for instance, mark the right edge of the intonational phrase (utterance), or it may be associated with the syllable bearing nuclear stress. Furthermore, continuation “rises” may contain a falling portion, e.g. the rise-fall pattern in Russian (Bryzgunova’s, 1980, IK-3, Yokoyama’s, 2001, LH L-, and presumably Makarova’s, 2003, L+H*.L..L%), and completion “falls” may contain a rising portion, e.g. the rise-fall in the Freiburg variety of German (cf. L-h-l% in Gilles, 2005, p. 139). In other words, the identification of a particular tune as falling or rising may become a rather involved theoretical issue, so one might sometimes be confronted with “continuation falls” and “completion rises.” However, these details are irrelevant for the discussion below. As long as a particular language makes an intonational distinction between the functions of continuation and completion in the above sense, I will use a simple-minded arrow notation to indicate this distinction: (\nearrow) for continuation, and (\searrow) for completion, for the moment neglecting the actual phonetic/phonological realisation.

Taking this intonational distinction into account we get four possible realisations of a sequence of two utterances: (a) completion-completion; (b) completion-continuation; (c) continuation-completion; and (d) continuation-continuation, cf. (181). The assumption is that there is at most one relevant rising or falling tune per utterance—the one that characterises the nucleus of its last intonational phrase.

- (181) a. $U_1 (\searrow) U_2 (\searrow)$
 b. $U_1 (\searrow) U_2 (\nearrow)$
 c. $U_1 (\nearrow) U_2 (\searrow)$
 d. $U_1 (\nearrow) U_2 (\nearrow)$

The hypothesis in (179) only concerns the first case—the completion-completion pattern in (181a). However, it is instructive to take a brief look at all four. In particular, special attention will be paid to the continuation-continuation pattern, which presents a good contrast to completion-completion in terms of its influence on the inference of implicit discourse relations.

Continuation-continuation

To begin with, the combination of the $U_1 (\nearrow) U_2 (\nearrow)$ pattern with asyndetic connection is typical for non-final parts of coordinate structures. It is a well-known phenomenon that certain coordinating conjunctions, primarily *and* and *or*, can connect more than two constituents, in which case the conjunction need not be repeated after each non-final element, that is, *John and Mary and Bill* means the same as *John, Mary and Bill*. The non-final elements in such structures are normally uttered with some kind of continuation intonation:

- (182) A: Who ate the beans?
 B: John (\nearrow), Mary (\nearrow), and Bill (\searrow)

Thus if we ignore the third coordinated element in (182), the first two present a case of asyndetically connected utterances congruent with the question that exhibit the continuation-continuation pattern. The same trick can be used with full sentences, where discourse markers like *then*, apparently, show similar behaviour to *and*. In particular, *then* need not be repeated after each sentence in (183b) in order to convey the idea that all the three eventualities are temporally ordered, and not just the last one relative to the first two. Obviously, this is the phenomenon that was intended to be captured by the mechanism of backward spreading of discourse relations proposed by Asher and Lascarides (2003) and discussed in Chapter 2.²⁴ In such cases, the discourse relation between U_1 and U_2 is constrained by the discourse marker in U_3 , e.g. *Continuation* in the case of *and* in (183a), or *Narration* in the case of *then* in (183b).

(183) A: What did Kim do today?

- B: a. She watched TV (↗), she studied (↗), *and* she went out (↘).
 b. She watched TV (↗), she studied (↗), *then* she went out (↘).

Of course, the answers in (182) and (183) do not satisfy the constituency criterion. *B*'s turn does not end after U_2 , and presumably, U_1 and U_2 only form a constituent together with the third utterance. However, it is possible that $\langle U_1, U_2 \rangle$ with a continuation-continuation pattern form a constituent in other cases. One case where U_1 and U_2 should probably be analysed as a single constituent (although they do not satisfy the current constituency heuristic and do not form a complete turn) is given in (184). Arguably, at least on one of the possible readings the adversative marker *but* contrasts the third utterance with both previous utterances here, i.e. with the constituent they form.

(184) A: What did Kim do today?

- B: She watched TV (↗), she studied (↗),
but she forgot to do the cleaning (↘).

Finally, speaker *B* can just stop after U_2 and leave his/her turn at that in spite of the continuation projected by the intonation pattern. Such an answer indicates that this is not an exhaustive list of Kim's activities today.

(185) A: What did Kim do today?

- B: She watched TV (↗), she studied (↗) ...

One might wonder, of course, whether such "unfinished" lists should be viewed as well-formed discourses. Indeed, the answer in (185) may be perceived as mildly suboptimal in turn-final position, which might be due to two factors. Firstly, as conversation analysts have proposed, continuation intonation is a turn-holding device, i.e. a turn transition is inhibited after (↗). In particular, it may take some time for the next speaker to make sure that *B* is not going to continue in spite of the intention projected by the intonation. The following German example from Selting (2003, p. 54) illustrates this situation, cf. Figure 3.5. (The English translation is given in (187). The transcription of prosody is adjusted to the current notation.) The Moderator first comes with a backchannel device *hmm*, and only after registering Kathi's resignation takes the turn himself. Examples like this, however, also show that continuation rises in turn-final position do occur and, probably, do not make the sequence

²⁴See Section 2.2.4, pp. 54–55, and Section 2.3.3, pp. 66–67.

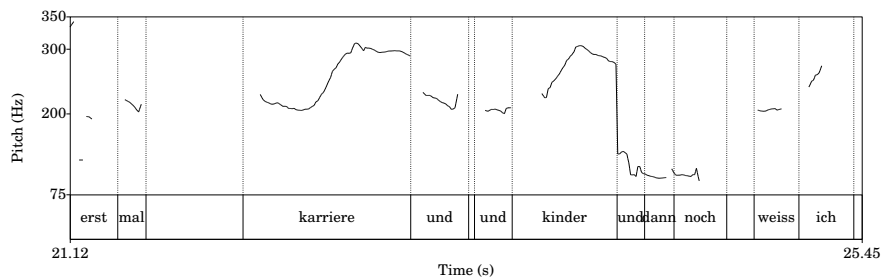


Figure 3.5: The pitch track to (186c)–(186e). A continuation rise ending in a high plateau is realised on *karriere* and *kinder*.

uninterpretable.

- (186) a. Kathi: ...
 b. also ich find das n (sagn wa mal)
 n bißchen zu VIEL so (↘)
 c. erst mal (.) KARRIERE (↗)
 d. und und KINDER (↗)
 e. und dann noch weiß ICH (↗)
 f. Moderator: hmm
 g. Kathi: ahh
 h. Moderator: du bist jetzt FÜNFZEHN (↘) kathi
 i. wie wärst DU (↘) denn als SUPERWEIB (↘)
- (187) a. Kathi: ...
 b. you know i think that's (I would say)
 just a bit too much (↘)
 c. firstly the career (↗)
 d. and and children (↗)
 e. and then what do i know (↗)
 f. Moderator: hm
 g. Kathi: argh
 h. Moderator: you are now fifteen years old (↘) kathi
 i. what would you be like as a superwoman (↘)

Another factor that could be responsible for the somewhat suboptimal character of the answer in (185) is the number of items in the list. Once again, one of the findings of conversation analysis is that enumerations of three (or more) elements make better lists, cf. e.g. (180) above. Jefferson (1990) points out, for instance, that lists consisting of three elements are particularly common in everyday talk and argues that they are generally planned by speakers as ternary structures. If the speaker has difficulties finding an appropriate third element, a *generalised list completer* (GLC), such as *and things like that*, *and so on*, etc. is often used to fill the third slot. Note, however, that a GLC does not have to be realised with a completion intonation, e.g. *und dann noch weiß ICH* ('and then what do i know') in (186e)/(187e) has a rise. Thus, the idea expressed by the answer in (185) would perhaps be expressed more coherently by something like

(188), no matter whether the GLC has a completion or a continuation tune.

(188) She watched TV (\nearrow), she studied (\nearrow), and things like that ...

Although these considerations are certainly valid, for the purposes of comparison with the completion-completion pattern discourses like (185) will be treated as well-formed and instantiating the structure in Figure 3.2, p. 84. In fact, the hypothesis is that despite the penalties mentioned above such discourses are perceived as *more* coherent than those with the completion-completion pattern, which will be discussed in more detail later in this section.

The next question is which implicit discourse relations are possible in such structures between asynchronously connected U_1 and U_2 exhibiting a continuation-continuation pattern. I hypothesise that such constructions generally pattern with *and*-conjunctions. I.e. on the one hand, they create a certain bias for the coordinating discourse relations *Continuation*, *Parallel*, *Narration*, and perhaps *Result*.²⁵ The choice between these relations is then largely determined by the semantics of the sentences. If lexical and world knowledge does not support a more specific inference, a weak *Continuation* relation is established, e.g. in (185). If there is lexical information that, for instance, one eventuality *occasions* the other, then *Narration* can be drawn, which is probably the case in the example below (cf. Chapter 2, pp. 53–54).²⁶

(189) A: What happened next?

B: The lone ranger jumped on his horse (\nearrow),
he rode into the sunset (\nearrow) ...

It should be noted though that unlike *and*-conjunctions, asyndetic connections with a continuation-continuation pattern appear not to favour discourse relations that cannot spread, e.g. the ‘denial of expectation’ type of *Contrast* (concession) or *Consequence* (conditional), cf. Chapter 2, pp. 54–55. Thus in (190a) the speaker presents the two facts as contradictory, whereas (190b) does not create the same impression—here the speaker simply lists the properties of Max. This phenomenon must be related to the underlying nature of U_1 (\nearrow) U_2 (\nearrow) as an “incomplete version” of coordinate structures like (183) and (184), as well as the intrinsically binary character of the semantics of concession and conditional, even when they are expressed by syntactically coordinate structures.

(190) A: What kind of person is Max?

B: a. Max can’t read (\nearrow), *and* he is a linguist (\searrow).
b. Max can’t read (\nearrow), he is a linguist (\nearrow) ...

On the other hand, if the semantics of the sentences in combination with the world knowledge suggests a subordinating relation (*Elaboration*, *Explanation*), or a non-spreading coordinating relation as in the above example, asyndetic connection with the continuation-continuation pattern is again similar to *and*-

²⁵See Table 2.2, in Chapter 2, p. 72, the survey in Section 2.1 and the discussion of Txurruka (2003) in Section 2.3.1.

²⁶If conversation analysts like Gilles (2005) are right in that temporally ordered sequences receive a different set of continuation tunes than temporally unordered ones, then intonation might be a further cue that distinguishes between *Narration* and *Continuation* in the construction under discussion. However, such studies usually do not treat asyndetic connection separately from other connection modes, so we do not know if the distinction is made by intonation alone, or some textual discourse marker it correlates with.

conjunction in that it does not render the discourse incoherent. Thus, the inference of *Explanation* in (191) or *Particularisation* in (192) might be inhibited to a greater or lesser extent,²⁷ but the discourses are felicitous.

(191) A: What happened to Max?
 B: Max fell (↗) , John pushed him (↗) ...

(192) A: What did Fred do?
 B: He damaged a garment (↗) , he stained a shirt (↗) ...

In other words, asyndetic connection with the continuation-continuation pattern does not impose any *semantic* constraints on U_1 and U_2 —one can list more or less anything. In this respect, continuation-continuation contrasts with other intonation patterns discussed below.

Continuation-completion

Asyndetic connection in a pair of utterances that form a discourse constituent and pertain to the same question seems to have a more restricted usage with the continuation-completion pattern U_1 (↗) U_2 (↘) than with continuation-continuation. Continuation-completion appears very natural on utterance pairs where the connection is explicitly signalled:

(193) A: What happened to Max?
 B: a. Max fell (↗) , *because* John pushed him (↘) .
 b. Max fell (↗) , *and* John pushed him (↘) .

However, this is less so with asyndetic connection. The contrast is most evident with non-sentential utterances, as in (194). The combination of asyndetic connection with continuation-completion in (194a) leads to incoherence, whereas coherence is maintained if either the intonation pattern is replaced by continuation-continuation, cf. (194b), or a conjunction *and* is inserted (194c).

(194) A: Who ate the beans?
 B: a. # John (↗) Mary (↘) .
 b. John (↗) , Mary (↗) ...
 c. John (↗) *and* Mary (↘) .

With full sentences, the effect of asyndetic connection plus continuation-completion is less dramatic, but it certainly makes the discourses more marked. Thus (195) is more marked than both (193) and (191) above.

(195) A: What happened to Max?
 B: ? Max fell (↗) , John pushed him (↘) .

Continuation-completion sounds more natural if the semantics of U_1 and U_2 and the associated world knowledge suggest a *Result* or a *Consequence* relation.²⁸ The *Result* relation with U_1 (↗) U_2 (↘) is illustrated by the Russian example (196)/(197) adapted from Bryzgunova (1982, p. 652);²⁹ a relevant ex-

²⁷See the related discussion of *and*-conjunction in Chapter 2, pp. 27–29.

²⁸A ‘formal’ *Contrast* relation is also possible with U_1 (↗) U_2 (↘) if it is supported by the presence of contrastive topic accents. However, utterances with contrastive topics are not considered for reasons that were discussed in Section 3.1.2.

²⁹Bryzgunova suggests that a combination of the IK-3 rise on the first sentence with the IK-1 fall on the second sentence support a conditional/resultative interpretation, in contrast

ample of *Consequence* was discussed in Chapter 2, see (69b) on p. 31. However, if the semantics of U_1 and U_2 does not naturally support these relations, which is apparently the case in (195), then either a reinterpretation in terms of a resultative/conditional relationship must be attempted, or the discourse is perceived as not perfectly coherent.³⁰

- (196) A: Čto slučilos' ?
 what happen.PERF.PAST
 B: Trener zabolet (↗) , zanjatija perenesli (↘) .
 coach fall-ill.PERF.PAST.SG training postpone.PERF.PAST.PL

- (197) A: What happened?
 B: The coach fell ill (↗) , (so) they cancelled the training (↘) .

These examples suggest that the continuation-completion pattern on asynchronously connected utterances interacts with the semantics of those utterances in a more restrictive fashion than continuation-continuation does. This issue will not be investigated any further here.

Completion-completion

Now let's turn to the intonation pattern of our primary concern: U_1 (↘) U_2 (↘). According to the hypothesis in (179), only *Explanation* and a subset of the varieties of *Elaboration* can be inferred between U_1 and U_2 that both bear a completion intonation and are connected asynchronously. The relevant subset of the *Elaboration* relations includes *Reformulation*, *Particularisation*, and *Generalisation*, i.e. relations that hold between two statements that, roughly speaking, say the *same* thing, or describe the *same* eventuality. Henceforth, this class of relations will be referred to as *Restatement*, in contrast to *Elaboration* proper that holds between U_1 and U_2 , where U_2 describes a proper part of the main eventuality of U_1 .³¹ Thus I submit that the completion-completion pattern in combination with asynchronous connection only licenses *Explanation* and *Restatement*.³² If the semantic content of U_1 and U_2 and the associated world knowledge is incompatible with an *Explanation* or a *Restatement* reading, then either the sequence remains incoherent, or the hearer is must try his/her best

to IK-1 falls on both sentences that indicate a simple temporal sequence. See Section 3.3 for some introductory remarks on Bryzgunova's IK-system for Russian intonation.

³⁰Recall our current assumption that U_1 and U_2 constitute the complete dialogue turn of speaker *B*. The continuation-completion sequence might be more felicitous when embedded in a longer monologue, where the use of the rise or the fall can be motivated by factors in broader context, in which case U_1 and U_2 might not be forming a single discourse constituent. A possible instance is (i) which differs from (194a) only in that the sequence *John* (↗) *Mary* (↘) is preceded by a third list element. This alone seems to increase the felicity of the answer.

- (i) A: Who ate the beans?
 B: Bill (↗) John (↗) Mary (↘) .

³¹See Chapter 2, pp. 21–25, for introductory remarks and examples of the *Elaboration* family of relations.

³²It is possible that also *Result* should be added to this class. Interestingly, *Result* has been noticed to show ambivalent behaviour in various respects, sometimes patterning with subordinating discourse relations like *Explanation* and *Elaboration*, and sometimes with coordinating relations like *Narration* and *Continuation* (see e.g. Asher and Vieu, 2005). I suspect that *Result* might also be a borderline case in terms of its behaviour with respect to the choice of intonational patterns. Because of the transcendent nature of this relation in what follows I will avoid discussing it.

(a) to reinterpret U_1 and U_2 to fit one of the relations, or (b) to resegment the sequence in a way that U_1 and U_2 do not form a discourse constituent or do not pertain to the same question under discussion. Reinterpretation and resegmentation are assumed to be costly operations that contribute to the suboptimal character of the discourse.

Many examples where the asyndetic connection with a completion-completion pattern produces a perfectly coherent discourse were considered in Chapter 2, pp. 21–27. Although intonation was not discussed there, completion was tacitly assumed to be the most natural pattern for sentences ending with a period. Some of these examples are repeated below, (198) illustrates *Explanation*, and (199) and (200) illustrate *Restatement*.

- (198) A: What happened to Max?
 B: Max fell (\searrow) . John pushed him (\searrow) .
- (199) A: What did Fred do?
 B: He damaged a garment (\searrow) . He stained a shirt (\searrow) .
- (200) A: What is so special about the beginning of this piece?
 B: At the beginning of this piece there is
 an example of an anacrusis (\searrow) .
 It begins with an unaccented note
 which is not part of the first full bar (\searrow) .

Some more or less clear cases where the semantics of the sentences conflicts with the *Restatement/Explanation* interpretation have also already been discussed in Chapter 2, cf. especially pp. 66–67 and Section 2.5. These are the cases where U_1 and U_2 cannot consistently describe the same eventuality, or the proposition expressed by U_1 normally implies the negation of the proposition expressed by U_2 (if p_1 then normally not p_2). Thus watching TV and studying, as well as praising and criticising normally cannot characterise one and the same activity, cf. (201) and (202). Similarly, if someone cannot read in the literal sense of the word means that the person normally cannot be a linguist, cf. (203). Note, however, that replacing the completion-completion pattern with continuation-continuation (cf. the (b) versions) makes the discourses much more coherent, and the contradiction effect in (202) disappears, although the connection remains asyndetic. Thus (202b) is a simple listing of distinct activities performed by Mary.

- (201) A: What did Kim do today?
 B: a. ?? Kim watched TV (\searrow) . She studied (\searrow) .
 b. Kim watched TV (\nearrow) , she studied (\nearrow) ...
- (202) A: What did Mary say in the project meeting?
 B: a. # Mary criticised John (\searrow) . She praised him (\searrow) .
 b. Mary criticised John (\nearrow) , she praised him (\nearrow) ...
- (203) A: What kind of person is Max?
 B: a. ?? Max can't read (\searrow) . He is a linguist (\searrow) .
 b. Max can't read (\nearrow) , he is a linguist (\nearrow) ...

Due to the semantics of the sentences the only discourse relations that would be plausible in the above cases are the 'denial of expectation' type of *Contrast*

and *Continuation* (since the latter is loose enough to tolerate the semantic contrast or the semantic “unrelatedness” of the utterances). Thus apparently, asyndetic connection with the completion-completion pattern prevents the inference of these relations.

The rest of this subsection is devoted to the discussion of more controversial cases. Our hypothesis implies that the asyndetic connection with the completion-completion pattern does not admit *Elaboration* proper, or the coordinating relations like *Parallel* and *Narration*, which are usually believed to go well with asyndetic connection, cf. Chapter 2, Section 2.1.3. Let’s first look at the coordinating relations.

According to Asher and Lascarides (2003), the *Parallel* relation is inferred if there is a high degree of formal parallelism between two utterances, i.e. their strongest common abstract is relatively strong. This is the case in examples like (204) and (205), the strongest common abstract being *X was looking in the garden for the lost cat*. According to the current hypothesis, (204a) and (205a) that realise a combination of asyndetic connection with a completion-completion pattern, are less coherent than the other versions, where either the intonation pattern is continuation-continuation, cf. (204b) and (205b), or a connector is used: *and* in (204c) or the *Parallel* marker *too* in (204d) and (205c).

(204) A: Who was looking in the garden for the lost cat?

- B: a. ?? JOHN (\searrow) was looking in the garden .
 MARY (\searrow) was looking in the garden .
 b. JOHN (\nearrow) was looking in the garden ,
 MARY (\nearrow) was looking in the garden ...
 c. JOHN (\searrow) was looking in the garden .
 And MARY (\searrow) was looking in the garden .
 d. JOHN (\searrow) was looking in the garden .
 MARY was looking in the garden, TOO (\searrow) .

(205) A: What was going on?

- B: a. ?? John was looking in the garden for the lost CAT (\searrow) .
 MARY (\searrow) was looking in the garden .
 b. John was looking in the garden for the lost CAT (\nearrow) ,
 MARY (\nearrow) was looking in the garden ...
 c. John was looking in the garden for the lost CAT (\searrow) .
 Mary was looking in the garden, TOO (\searrow) .

There are two possible ways to “save” discourses like (204a) and (205a) and assign them a coherent interpretation. One possibility is to interpret the second utterance as a *Correction*, cf. (206). However, if the speaker does not explicitly signal that the first utterance is being withdrawn by using a marker like *oh no*, or *ehm*, or at least some appropriate prosody or gesture, then the discourse is confusing.

(206) A: Who was looking in the garden for the lost cat?

- B: a. JOHN (\searrow) was looking in the garden .
 Oh no! MARY (\searrow) was looking in the garden .
 b. JOHN (\searrow) was looking in the garden .
 ehm... MARY (\searrow) was looking in the garden .

The other possibility is to understand (204a) as the beginning of a list, cf. (207). Although a continuation rise is a more common intonation pattern for list items, falling intonation is also possible. However, in order to recognise such a sequence as a list, additional conditions have to be met. First, it must indeed have a third item. If the speaker just stops after producing the second item, as in (204a), then the list interpretation seems much harder to access.³³ Second, the pauses between the utterances in a falling intonation list would probably be shorter than those between U_1 (\searrow) and U_2 (\searrow) in a coherent *Explanation* or *Restatement* discourse like (198)–(200). If in addition to the melody one takes the pause length into account in delimiting completion from continuation intonation, then the prosodic pattern in (207) might after all be classified as continuation, rather than completion.³⁴

- (207) A: Who was looking in the garden for the lost cat?
 B: JOHN (\searrow) was looking in the garden ,
 MARY (\searrow) was looking in the garden ,
 BILL (\searrow) was looking in the garden ...
 (So many people were looking in the garden!)

Thus I take the contrasts in coherence illustrated above as preliminary support for the hypothesis that asyndetic connection in combination with the completion-completion pattern conflicts with the inference of the *Parallel* relation.

Narration presents perhaps the most controversial case. Recall that *Narration* can be inferred in the absence of explicit cues if the lexicon or the domain knowledge supports an *occasion* relation between the utterances. That is, there's a plan or a 'natural event-sequence' such that events of the sort described by U_1 lead to events of the sort described by U_2 (Asher and Lascarides, 2003, pp. 200–201).³⁵ If the content of U_1 and U_2 naturally suggests a *Narration* interpretation, as e.g. in (208), the difference in acceptability between completion-completion and continuation-continuation is smaller than in the case of *Parallel*, cf. (208a) and (208b) vs. (204a) and (204b). However, I hypothesise that such a difference exists, and that (208a) is a less coherent answer to the given question than (208b) or (208c), assuming that speaker *B*'s turn ends after the second utterance and there is no continuation, and assuming that all *B* wants to imply is a temporal sequence relationship between the two eventualities.

³³Lerner (1994) has argued that a list becomes recognisable as being under way already after the production of the second item. However, he does not consider intonation. I conjecture that this observation applies primarily to lists with continuation rises.

³⁴It should also be noted that at least certain kinds of falling intonation on list items have an additional pragmatic effect: (207) has an implicature that *so many* people were looking in the garden for the lost cat, whereas the version with rising intonation would sound comparatively neutral. See Chapter 6, Section 6.7.1 for some remarks on this issue.

³⁵See Chapter 2, pp. 53–54.

- (208) A: What happened next?
 B: a. ? The lone ranger jumped on his horse (↘) .
 He rode into the sunset (↘) .
 b. The lone ranger jumped on his horse (↗) ,
 he rode into the sunset (↗) ...
 c. The lone ranger jumped on his horse (↘) .
 And he rode into the sunset (↘) .

One might or might not agree with the intuitions expressed in (208). For reasons that will be discussed in Section 3.2, I do not expect these contrasts to be clearly reflected by the conscious coherence judgements of speakers. However, studies of spontaneous speech provide some preliminary support for the proposed hypothesis, showing that patterns like (208b) and (208c) are considerably more common with sequences of temporally ordered events than (208a). On the other hand, asyndetically connected sentences ending with a period are often used for narrative sequences in written language. Since periods are standardly expressed using a completion intonation in reading aloud, (208a) is presumably a common pattern for *Narration* in read speech. In other words, as far as *Narration* is concerned, the current hypothesis probably cannot be universally maintained for all speech modes, and should be applied primarily to spontaneous discourse.

Finally, according to the current hypothesis *Elaboration*-proper is not among the implicit discourse relations that can be coherently inferred between asyndetically connected U_1 (↘) and U_2 (↘) that form a complete discourse constituent. Recall that *Elaboration*-proper holds if the main eventuality of the second utterance constitutes a *proper* mereological part of the main eventuality of the first utterance, in contrast to *Restatement* where the eventualities must corefer (cf. *Particularisation/Generalisation*, Chapter 2, pp. 22–24). For instance in (209), the semantics of the sentences supports a proper part-whole relationship between the described eventualities—drawing plans is usually one step in building a bridge. However, (209) does not support event coreference since building a bridge does not boil down to drawing plans. I submit that such discourses sound rather bad with a completion-completion pattern, assuming that speaker *B* ends his/her turn after uttering U_2 .

- (209) A: What did the council do?
 B: ?? The council built the bridge (↘) .
 They got an architect to draw up the plans (↘) .

The discourse can become better if it has an appropriate continuation, cf. (210). However, in (210) the first two utterances arguably do not form a discourse constituent. Rather, the utterances presenting the different steps of building the bridge make up a constituent which is related to the introductory sentence at a more global structural level.

- (210) A: What did the council do?
 B: The council built the bridge (↘) .
 They got an architect to draw up the plans (↘) .
 Then they engaged a building company to carry out the
 project (↘) .
 ...

It seems that in order to get a felicitous *Elaboration*, one has to mention *all* the essential parts of the eventuality introduced in U_1 . However, in that case the complex event corresponding to the sum of those parts can be assumed to corefer with the U_1 -event, so after all, a *Restatement* relation can be established between U_1 and $\langle U_2, U_3, \dots \rangle$, whereas *Elaboration*-proper holds between U_1 and U_2 , U_1 and U_3 , etc. In other words, *Elaboration*-proper must always be embedded in a bigger *Restatement* structure.

There are some examples frequently discussed in the literature that at first glance cast doubt on this generalisation, e.g. (211) adapted from Danlos (1999). The version in (211a) appears quite coherent despite the completion-completion pattern, although Danlos points out that a trip by plane cannot be reduced to a takeoff and a landing, and thus the relationship between the utterances in (211a) is not based on event coreference. It is therefore important to relativise the notion of event coreference to the “zoom level” with which one looks upon events. At a greater level of detail, an international flight consists of passing customs, checking in, passing the passport control, waiting for the boarding and, perhaps, hanging around in duty-free shops, passing the security control, boarding, take-off, the flight in the narrow sense including the stewardesses passing around drinks and meals, landing, passport control, luggage reclaim, and finally customs. At a lower level of detail, one can overlook certain stages concentrating on the most essential ones, e.g. just the takeoff and the landing in case of a flight. The appropriate level of detail depends partly on the nature of the described eventuality and partly on the current needs of communication. Thus the takeoff and the landing can be viewed, perhaps, as equally “constitutive” of a flight, and more constitutive than, for instance, the check-in. Notice that it is harder to see the takeoff without the landing as the *only* essential part of a flight. Therefore (211b) is a worse *Restatement* than (211a), which makes it less coherent with the completion-completion pattern.

(211) A: What did Nicholas do yesterday?

- B: a. Nicholas flew from Austin to Paris (\searrow) .
 He took off at 6 am and he landed at 2 pm (\searrow) .
 b. ? Nicholas flew from Austin to Paris (\searrow) .
 He took off at 6 am (\searrow) .

However, a great role is also played by what is relevant in the current context. For instance, if the communication in (211) takes place in a situation of investigating a murder which occurred in Austin yesterday at 7 am, then the information that Nicholas took off at 6 am flying to Paris is sufficient for an alibi. In this case, the takeoff can indeed be viewed as the most essential part of the flight, thus (211b) makes a better *Restatement* and the completion-completion pattern is also more appropriate.

In light of these considerations, the relative infelicity of (209) is a consequence of the fact that it is very hard to accommodate a context in which drawing up plans is the most essential part of building a bridge. At best, a rather humorous reading comes to mind in which the council’s activities in connection with the bridge building are indeed limited to engaging an architect and dodging all responsibility afterwards. Under this reading the completion-completion pattern is perfectly felicitous.

In sum, I hypothesise that *Elaboration*-proper cannot be coherently in-

ferred between two asyndetically connected utterances that form a discourse constituent and realise the completion-completion pattern. If this nevertheless appears to be the case it must be the effect of the level of detail at which the events are being presented.

Completion-continuation

Finally, let's briefly mention the last pattern formed by a combination of a completion and a continuation intonation: $U_1 (\searrow) U_2 (\nearrow)$. In general, this pattern is rather inappropriate in turn-final position for largely the same reasons as the continuation-continuation pattern discussed earlier, that is, primarily because the continuation intonation projects a continuation but no continuation comes. However, it is much harder to accommodate as an incomplete list than $U_1 (\nearrow) U_2 (\nearrow)$. At best, U_2 alone can be viewed as the first element of a list, which is even further away from the ideal three-part list structure. Interestingly, however, $U_1 (\searrow) U_2 (\nearrow)$ works better with *Elaboration*-proper than $U_1 (\searrow) U_2 (\searrow)$. Thus (212b) is more coherent than (212a), although it is not perfect either.

- (212) A: What did the council do?
 B: a. ?? The council built the bridge (\searrow) .
 They got an architect to draw up the plans (\searrow) .
 b. ? The council built the bridge (\searrow) .
 They got an architect to draw up the plans (\nearrow) ...

The contrast between (212a) and (212b) provides further support for the point stated above concerning the relationship between *Elaboration*-proper and *Restatement*. *Elaboration*-proper must be part of a *Restatement*. The continuation intonation on U_2 in (212b) can be interpreted as an indication that drawing up plans constitutes the first of a number of stages, the hearer thus accommodates a continuation with remaining sub-events which in sum constitute, i.e. corefer with the bridge building. Thus *Elaboration*-proper between U_1 and U_2 can be accommodated as part of a bigger (though unrealised) structure that features *Restatement*.

3.1.4 Summary

In this section, I have formulated the following hypothesis and illustrated it by a number of examples.

- (213) If the sequence of adjacent asyndetically connected declarative utterances $\langle U_1, U_2 \rangle$ satisfies the following conditions:
 a. U_1 and U_2 form a (complete) discourse constituent;
 b. U_1 and U_2 pertain to the same question under discussion;
 c. U_1 and U_2 each are realised with completion intonation;
 then only *Explanation* and *Restatement* can be inferred between U_1 and U_2 in the absence of overt cues, thus if the content of U_1 and U_2 does not support an *Explanation* or a *Restatement* reading, then the discourse is not optimally coherent.

The assessment of this hypothesis has required introducing the notions of discourse constituent, question under discussion, an utterance pertaining to a

question, etc. Although no general characterisation of the mapping between discourses and discourse structures based on these notions has been provided, a number of heuristics have been proposed that should help pin down a subset of the cases relevant for evaluating the proposed hypothesis. Thus the hypothesis could have just as well been formulated in a weaker and less general form without reference to such theory-specific notions as question under discussion, cf. (214). However, the QUD terminology was chosen first of all in order to introduce some structure into and partly motivate the set of conditions (214a)–(214e), which might seem rather arbitrary at first glance. Second, QUD structures will prove useful in Chapter 4 when it comes to explaining the hypothesised pattern.

- (214) If the sequence of adjacent asyndetically connected declarative utterances $\langle U_1, U_2 \rangle$ satisfies the following conditions:
- a. U_1 and U_2 form a complete dialogue turn of speaker B ;
 - b. U_1 and U_2 immediately follow an interrogative utterance by speaker A ;
 - c. U_1 and U_2 are both congruent with that interrogative;
 - d. U_1 and U_2 do not contain linguistic or prosodic markers of discontinuity;
 - e. U_1 and U_2 each are realised with completion intonation each;
- then only *Explanation* and *Restatement* can be inferred between U_1 and U_2 in the absence of overt cues, thus if the content of U_1 and U_2 does not support an *Explanation* or a *Restatement* reading, then the discourse is not optimally coherent.

Finally, in this section I have paid special attention to the last premise (214e) of the current hypothesis, and more broadly to the role of intonation in constraining the range of possible implicit discourse relations. Given a two-way distinction between continuation (\nearrow) and completion (\searrow) intonation, four intonational realisations were considered for a sequence of two utterances: continuation-continuation; continuation-completion; completion-completion; and completion-continuation. In particular, the comparison of the continuation-continuation pattern, $U_1 (\nearrow) U_2 (\nearrow)$, with completion-completion, $U_1 (\searrow) U_2 (\searrow)$, suggests that utterance pairs exhibiting asyndetic connection fall into at least two classes which show rather different behaviour with respect to the inference of implicit discourse relations, see Table 3.2.

It is interesting to compare Table 3.2 with Table 2.1, in Chapter 2, p. 33, which is based primarily on the observations in the pragmatics literature. The way the set of implicit discourse relations that are possible with asyndetic connection is split between the $U_1 (\searrow) U_2 (\searrow)$ and the $U_1 (\nearrow) U_2 (\nearrow)$ pattern raises a suspicion: The common assumption that the asyndetic connection is less restrictive with respect to the choice of discourse relations than the *and*-conjunction could be a consequence of insufficient attention to prosody. By contrast, the combination of asyndetic connection with the completion-completion pattern seems to impose very severe restrictions on discourse relations, allowing only for *Explanation* and *Restatement* among the relations mentioned in Table 3.2.³⁶

³⁶It is perhaps useful to briefly recapitulate the status of discourse relations that have been ignored in Table 3.2, as compared to Table 2.1, p. 33. The relations of ‘formal’ *Contrast* and *Background* were excluded since due to the considerations presented in Section 3.1.2, they are assumed never to occur between utterances pertaining to the same question under discussion at the most local level of discourse structure. This is in a way similar to *Elaboration*-proper

	Asyndetic connection		<i>And</i>
	$U_1 (\searrow) U_2 (\searrow)$	$U_1 (\nearrow) U_2 (\nearrow)$	
Narration	*	✓	✓
Continuation	*	✓	✓
Parallel	*	✓	✓
Elaboration-proper	*	*	*
Restatement	✓	*	*
Explanation & Co	✓	*	*
Contrast (concession)	*	*	✓
Consequence	*	*	*/✓
Alternation	*	*	*
Purpose	*	*	*

Table 3.2: Implicit realisation patterns of SDRT discourse relations. Legend: ✓ / * indicates that the given discourse relation can / cannot be inferred with the given mode of implicit connection between two utterances that form a discourse constituent and pertain to the same question under discussion.

Two last remarks should be made in connection with the topics discussed in this section. First, the distinction between continuation and completion intonation has been characterised in very general terms. The last premise of the current hypothesis (213c)/(214e) only gains substance when more can be said on the phonetics and phonology of this distinction in application to particular languages. This issue will be taken up in Section 3.3. Second, it should be emphasised that the hypothesis presented in this section is first of all a *hypothesis*. The examples and intuitions discussed in Section 3.1.3 can be viewed as an illustration by which I have tried to make the point more or less plausible. However, no empirical evidence has been presented so far. Some indirect evidence found in previous empirical research is reviewed in the next section.

3.2 Previous empirical studies

The hypothesis formulated in the last section calls for empirical testing, which goes beyond the scope of this dissertation. This section, however, presents and discusses some results reported in the literature that appear to have a bearing on the empirical validity of our hypothesis.

Ignoring some details for the moment, it was proposed that if the connection between the utterances U_1 and U_2 is asyndetic and both are realised with a completion intonation, $U_1 (\searrow) U_2 (\searrow)$, then *Restatement* and *Explanation* are the preferred implicit discourse relations, whereas the inference of other relations is

(note the * in all three columns of Table 3.2), which never connects utterances that form a complete discourse constituent, cf. Section 3.1.3, pp. 101–103. Moreover, I have deliberately excluded *Result* from consideration for the lack of clear intuitions regarding it, see fn. 32 on p. 97. It is possible that *Result* should be grouped with *Explanation* and *Restatement* as a further relation that combines with $U_1 (\searrow) U_2 (\searrow)$ without any penalties to the coherence of the discourse. On the other hand, examples like (30) discussed in Chapter 2, p. 19, suggest that *Result* might also sometimes behave like *Narration* and other coordinating relations. In other words, *Result* deserves a more careful investigation which goes beyond the scope of the present study.

impeded in a certain sense. If either the completion intonation is replaced by continuation, $U_1 (\nearrow) U_2 (\nearrow)$, or a conjunction *and* is used to connect the utterances, then the bias moves towards such relations as *Narration*, *Continuation*, and *Parallel*. In other words, there is an interaction between the connection mode and intonation with regard to the inference of implicit discourse relations. Unfortunately, I am not aware of previous empirical work that simultaneously investigated the role of both factors. The studies discussed in this section have either concentrated on the connection mode, or on intonation, without paying careful attention to the other factor. Therefore, the results of these studies do not present evidence in the strict sense for or against the current hypothesis, although I do think that they give motivation for pursuing it. The relevant studies on discourse connectives are reviewed in Section 3.2.1; Section 3.2.2 is then concerned with the relevant previous work on intonation.

3.2.1 Asyndetic connection and *and*-conjunction in spoken and written language

This section reviews some previous corpus based studies on the usage of the connective *and* in discourse in contrast to the asyndetic connection. Although these studies, especially the influential work of Schiffrin (1987), have observed more similarities than differences in the functioning of these two modes of connection, it will be argued that these data do not present counterevidence to the hypothesis proposed in the previous section, since important parameters, such as intonation and discourse relations, were not considered systematically in these studies. However, a first, informal look at intonation in Schiffrin's examples will reveal an interaction between intonation and the usage of *and*. At the same time, I will argue that previously observed differences in the usage of *and* vs. asyndetic connection in spoken vs. written language are indicative of the associated biases for distinct sets of implicit discourse relations, as outlined in Section 3.1.

Free variation in spoken language?

Talking about inter-utterance connection in spoken language one should mention the classics such as Schiffrin (1981, 1986, 1987). In contrast to the studies surveyed in Chapter 2 or the observations in the previous section, Schiffrin has always emphasised the similarities rather than the differences in the functioning of the asyndetic connection and the connective *and*. In this section I will reconsider some of Schiffrin's arguments and take a closer look at her own examples which, in my opinion, suggest a rather more complex picture.

First of all, Schiffrin (1981) has observed that *and* and the asyndetic connection behave similarly in terms of their relationship with tense switching in everyday oral narrative. Whereas other connectives, e.g. *so*, *then*, *all of a sudden*, tend to co-occur with switching between the historical present and the preterit tenses, neither *and* nor the asyndetic connection favour switching. Given the observation that tense switches correlate with transitions between narrative episodes (i.e. bigger discourse structural units, cf. Section 3.1.2, pp. 86–87), the fact that both *and* and asyndetic connection avoid such points suggests that both modes of connection are used to link smaller and more closely related discourse units, whereas the major structural breaks apparently have to

be marked more explicitly. Note that this finding is perfectly consistent with our assumptions so far.

Further, Schiffrin (1986, 1987) suggests that the switch between *and* and the asyndetic connection can indicate a unit transition in discourse structure (presumably at a more local structural level than the tense switch). “If either *and* or ‘zero’ becomes a textual norm, speakers may then bracket a new idea segment by deviating from that norm to use the other mode of connection” (Schiffrin, 1987, p. 130). The switch from asyndetic connection to *and* is illustrated in (215). The speaker is listing the attempts of anti-Semites to destroy the Jewish tradition in (215a)–(215d). The list forms a discourse constituent which is connected at a more global level to (215e) by *Contrast*.³⁷ Thus here the asyndetic connection functions as an indicator of a closer structural relationship, whereas *and* indicates a looser connection.

- (215) a. They threw us in the fire,
b. they shot us,
c. they killed us,
d. they put us in the gas chambers,
e. *and* they couldn’t do it.

The pattern is reversed in (216), cf. Schiffrin (1987, p. 131), where *and* connects utterances (216c)–(216f) within a bigger segment (216b)–(216f) describing the way of living prior to automobiles. That segment as a whole is contrasted with (216g), the connection between (216b)–(216f) and (216g) is asyndetic. Thus here *and* signals a closer, and asyndetic connection a looser relationship between discourse units.

- (216) a. What changed the whole way of living is the automobile.
b. You couldn’t go anywhere,
c. *so* you congregated together,
d. *and* y’got in one big truck, or something,
e. *and* you went- went on a picnic,
f. *and* you had a good time.
g. Today, you could care less!

From this Schiffrin concludes that “there is nothing inherent in either *and* or ‘zero’ which makes one more suitable as a marker of a particular idea unit: the same textual segmentation could just as easily have been marked through the opposite pattern of switching” (Schiffrin, 1987, p. 130). This interchangeability is further illustrated by (217) and (218), where (217) is a naturally occurring sequence, and (218) is constructed by reversing the *and*/‘zero’ pattern. The two versions have the same discourse constituent structure.

- (217) a. I uh I go on trips with ‘em,
b. I bring ‘em here,
c. we have supper, or dinner here,
d. *and* I don’t see any problem
e. *because* I’m workin’ with college graduates.

³⁷Schiffrin analyses (215e) as a *summary* of (215a)–(215d), rather than contrasting with it, but note that *and* can be very naturally replaced by *but* in (215e). Thus, a ‘denial of expectation’ type of *Contrast* seems to be a more appropriate analysis.

- (218) a. I uh I go on trips with 'em,
 b. *and* I bring 'em here,
 c. *and* we have supper, or dinner here,
 d. I don't see any problem
 e. *because* I'm workin' with college graduates.

In other words, according to Schiffrin the choice between *and* and asyndetic connection is a matter of free variation, and it is only the switch from one connection mode to the other that has a discourse function. However, if this is intended to imply that the two modes of connection are interchangeable in all contexts, then I disagree. In particular, Schiffrin's own examples suggest that there is an interaction between the *and*/'zero' opposition and intonation.

Intonation is indicated in the conversation transcripts by punctuation marks, which is a common practice in conversation analysis. In particular, Schiffrin uses the following conventions (cf. Schiffrin, 1987, pp. ix-x):

- (219) . falling intonation followed by a noticeable pause (as at the end of a declarative sentence)
 ? rising intonation followed by noticeable pause (as at the end of an interrogative sentence)
 , continuing intonation: may be slight rise or fall in contour (less than '.' or '?'); may be followed by a pause (shorter than '.' or '?')
 ! animated tone
 ... noticeable pause or break in rhythm without falling intonation

Given these glosses, it is reasonable to assume that '.' corresponds roughly to completion (\searrow), whereas '?', comma, '...' and lack of punctuation correspond to continuation (\nearrow).³⁸

Before addressing the issue of interaction between intonation and the *and*/'zero' alternation, it should be mentioned that the contrast between the continuation and the completion tunes constitutes an independent discourse segmentation device. Often utterances within a discourse segment are "connected" by continuation rises, whereas discourse segments are "separated" from each other by falling intonation on the segment final utterance. This has been established in several systematic quantitative studies (see e.g. Swerts and Geluykens, 1994; Swerts et al., 1994), moreover, it is not simply the switch from one intonation pattern to the other that marks a transition between discourse segments. Continuation rises and completion falls have inherent values, continuation rise marking a *weaker* discourse structural boundary, i.e. closer connection between the utterances, and a completion fall marking a *stronger* boundary, i.e. a looser connection (cf. Swerts, 1997). Thus the patterns are certainly not interchangeable. Schiffrin illustrates the discourse segmentation function of intonation by (220), where *and* prefaces all the utterances, so the *and*/'zero' alternation cannot be playing any role. This discourse is segmented into "time periods" (220a)–(220b), (220c)–(220e), (220f)–(220g), and (220h) by the use of falling intonation plus a longer pause, indicated by a period.

³⁸It is hard to attribute '!' to either category.

- (220) a. *And* then we lived there for five years,
 b. *and* we bought- we bought a triplex across the street.
 c. *And* by that time we had two kids,
 d. *and* we moved on the first floor,
 e. *and* rented out the second.
 f. *And* his brother married then,
 g. *and* lived on the third.
 h. *And* we still live together down the shore.

Returning to the *and*/'zero' alternation, note first of all that it is not the only device that signals discourse segmentation in (215) and (216). In (215) where asyndetic connection functions at a more local level, the utterances are additionally "connected" by the "comma" intonation. In (216), where the asyndetic connection is supposed to indicate a stronger discourse structural boundary, it co-occurs with a "period" intonation, i.e. completion. I suspect that this is not a coincidence, and that the discourses would not retain the same structure and remain equally natural if, for instance, the intonation were uniformly changed to completion.

If we have a uniform sequence of continuation tunes, then indeed asyndetic connection and the conjunction *and* appear interchangeable in Schiffrin's sense, which is the case in (217)/(218). However, reversing the *and*/'zero' pattern does not seem to work the same way in a sequence of completion tunes, such as (221) where every utterance in the given fragment of speaker *B*'s reply ends in a "period" intonation (Schiffrin, 1987, p. 140). Here (221c) can be analysed as a *Restatement* of (221b), and (221d)–(221h) plus the subsequent utterances discussing the younger daughter in law form a further *Restatement* (*Particularisation*) of (221b) and (221c).³⁹ The utterances *within* this last segment are connected by *and*, whereas the connection *between* (221b), (221c), and (221d)–[...] is asyndetic. Thus *and* functions here at a more local level of discourse segmentation, and the asyndetic connection at a more global level, like in (216) above. However, with the reversed pattern of switching, given in (222), the discourse would sound less natural, especially if the intonation pattern remained the same. This suggests that *and* and the asyndetic connection between utterances ending in completion intonation are not interchangeable in Schiffrin's sense. This interaction is consistent with the generalisations summarised in Table 3.2 in the previous section. In other words, the conflict between Schiffrin's data and the current observations is probably only seeming.

***And* in spoken narrative**

An observation that lends indirect support to the hypothesis stated in Section 3.1 is the overwhelming frequency of utterances beginning with *and* in oral narrative, as in sequences like (220) above. It is a known fact that utterance-initial *and* is much more common in spoken than in written narrative (Labov, 1972; Chafe, 1982, 1985; Chafe and Danielewicz, 1987; Tannen, 1982a; Halliday, 1987). This feature is usually attributed to the "additive" character of spoken language, as opposed to the "subordinative" character of the written

³⁹Because of the expanded character of the last *Restatement* it would traditionally be analysed as *Elaboration* (cf. Mann and Thompson, 1988). However, in our broad understanding of the notion of *Restatement*, which is closer to Blakemore's (1997), the "bulk" of the segments it connects does not play a role, cf. the discussion in Section 3.1.3, pp. 97–103.

- (221) A: a. Do either one of your daughter in laws work?
 B: b. No but they did.
 c. Both my daughters in laws worked.
 d. Uh: my older daughter in law worked for four years while my son was in school.
 e. *And* she didn't become uh pregnant until he graduated.
 f. *And* uh: she feels that once her children are in school, she'd like to go back.
 g. *And* my younger daughter in law, uh: they got married when she was eighteen.
 h. *And* she uh: was just starting Beaver.
 [continues telling about the younger daughter in law]
- (222) A: a. Do either one of your daughter in laws work?
 B: b. No but they did.
 c. *And* both my daughters in laws worked.
 d. *And* uh: my older daughter in law worked for four years while my son was in school.
 e. She didn't become uh pregnant until he graduated.
 f. Uh: she feels that once her children are in school, she'd like to go back.
 g. My younger daughter in law, uh: they got married when she was eighteen.
 h. She uh: was just starting Beaver.
 [continues telling about the younger daughter in law]

language, which is reflected in the tendency of the written language to use more subordinate clauses. However, I conjecture that another factor contributing to the relatively greater frequency of *and*-coordination in spoken language could be a more restricted usage of asyndetic connection than in the written language. In particular, I put forward the hypothesis that sequences of asyndetically connected utterances ending in completion intonation are rather unlikely as expressing sequences of events in spontaneous speech.

For example, consider (223), where speaker *B*'s answer reports a sequence of events, i.e. the discourse relation between the utterances is *Narration* (Schiffrin, 1987, p. 142). Again, all non-initial utterances are prefaced by *and*, and all except (223d) end in "period" intonation. The coherence of this discourse would not suffer much if the continuation intonation in (223d) were replaced by completion and if the explicit markers of *Narration* such as *then* were removed, cf. (224). However, removing the conjunctions makes the discourse sound much less natural, or at least much less "conversational" with the given intonational pattern, cf. (225).

At the same time, it is not the case that asyndetic connection is not used at all in spontaneous speech between utterances bearing a completion intonation. It is just that when it is used, the discourse relation between the utterances is normally not *Narration*, but *Restatement* or *Explanation*. One example of such a *Restatement* is (221b)–(221c) above; another one is given in (226), cf. Schiffrin (1987, p. 138).

- (223) A: a. You lived in West Philly? Whereabouts?
 B: b. Well, I was born at 52nd and em... tsk... oh: I forgo- well.....
 I think its 52nd and Chew.
 c. *And* um... and uh I grew up really in the section called Logan.
 d. *And then*, I went into the service, for the two years,
 e. *and then* when I came back, I married... I- I- I got married.
 f. *And I- then* I lived at uh 49th and Blair.
- (224) A: a. You lived in West Philly? Whereabouts?
 B: b. Well, I was born at 52nd and em... tsk... oh: I forgo- well.....
 I think its 52nd and Chew.
 c. *And* um... and uh I grew up really in the section called Logan.
 d. *And*, I went into the service, for the two years.
 e. *And* when I came back, I married... I- I- I got married.
 f. *And I-* I lived at uh 49th and Blair.
- (225) A: a. You lived in West Philly? Whereabouts?
 B: b. Well, I was born at 52nd and em... tsk... oh: I forgo- well.....
 I think its 52nd and Chew.
 c. Um... uh I grew up really in the section called Logan.
 d. I went into the service, for the two years.
 e. When I came back, I married... I- I- I got married.
 f. I- I lived at uh 49th and Blair.

- (226) a. *And* uh: that's- that's the answer.
 b. That's why I say they're the most prejudiced.

The sequence in (227) in turn illustrates *Explanation*. Similarly, (228b) explains (228a), and (228d) explains (228c). All four utterances have a “period” intonation, but the utterances withing the *Explanations* are connected asynchronously, whereas the two *Explanations* are separated from each other by *but* (Schiffrin, 1987, pp. 147, 156).

- (227) a. Even this teacher, this one that- she laughed.
 b. She couldn't help it!

- (228) a. I used t'go every summer.
 b. My mother'd send me down with relatives.
 c. *But* I used t'cry I wanted to go home.
 d. I didn't like it.

Of course, asyndetic connection with falling intonation can also be used between larger discourse chunks that stand in a *Restatement* relation, as between (221c) and (221d)-[...] above, as well as in (229) and (230) below (Schiffrin, 1987, pp. 134, 146). However, as those discourse chunks get bigger, the co-occurrence of completion intonation plus asyndetic connection with other discourse relations including *Narration* and *Continuation* may become more likely, blurring the contrast to continuation intonation and *and*-conjunction. This might be related to the fact that bigger discourse constituents are necessarily connected to each other at a more global level than the utterances within them, so those constituents do not pertain to the same question under discussion at the most

local level. In this sense, such cases would not constitute counterevidence to the hypothesis proposed in Section 3.1. This means, however, that the sharpest contrasts between asyndetic connection plus completion intonation, on the one hand, and other connection modes on the other, will be found if we consider primarily discourse relations connecting small discourse segments of about the size of one clause, as in the examples (223)–(228).

- (229) A: a. What was the first job you had, when you got out of school.
 B: b. I worked in a: um coffee em... eh coffee manufacturing.
 c. They used to eh buy the coffee green,
 d. *and* uh- and I worked as the: eh billing clerk.
 A: e. Uhhuh.
 f. *And* when was that?

- (230) a. It varies.
 b. Among the Catholic you'll find a very staunch prejudiced person,
 c. *and* yet, you'll go to another state, and another area,
 d. *and* it's entirely different.

In sum, at least part of the reason for the high frequency of *and* in oral narrative may plausibly be that under completion intonation the asyndetic connection does not present an alternative to *and* in realising the discourse relation of *Narration*. In the terminology of the previous discussion, *Narration* cannot be so easily inferred between two asyndetically connected utterances bearing a completion tune in the absence of overt cues.

Sentence-initial *and* in written language

But if the current hypothesis is correct, and *Narration* indeed cannot be naturally conveyed by the $U_1 (\searrow) U_2 (\searrow)$ pattern in spoken language, one might wonder why the written language is different in this respect. Why are we so tolerant in our coherence judgements with respect to discourses like (231) (which I suppose is influenced by the written norm)? And why is there no requirement to use *and* at the beginning of the written sentence to express *Narration*?

- (231) The lone ranger jumped on his horse. He rode into the sunset.

Some interesting light is shed on this issue by historical studies of the development of the written language. Most remarkably, sentence-initial *and* used to be much more frequent at earlier stages. This can be clearly seen in the following excerpt from Fabian/*The New Chronicles of England* which belongs to the Early Modern English period (1500–1710), cited by Dorgeloh (2004):

- (232) a. *And vpon the Wednysdaye folowynge* was enactyd
 that Rycharde late Kynge of Englonde shulde for his
 missegouernaunce of the Realme be holdyn in such Pryson
 as the Kynge wolde assygne duryng his naturall Lyfe
- b. *And than* ye Kynge graunted to all persones generall pardons
 so that they were sette out of Chauncerye by Alhalowentyde nexte
 folowynge excepte such persones as were present at the murder of the
 Duke of Gloucetyr
- c. *And in this whyle* was the Archbyssshop of Cauntorbury
 and Doctour Roger
 whiche there was sette by Kynge Rycharde
 was remoued and sette in the See of London
 w=t= the which he was right well contentyd
- d. *And than* was the Erle of Arundellys sone restoryd to all his Fathers
 Landys with dyuerse other before by Kynge Rycharde

According to Dorgeloh, sentence-initial *and* is typical of narrative sequences in texts of that period, and the narrative sequence in turn constitutes the prevailing discourse strategy not only in texts narrative “by nature,” such as historical texts, cf. (232), but also in scientific texts where evidence is often recounted in the form of experience. However, Dorgeloh’s corpus study shows a clear decline of the frequency of sentence-initial *and* in both scientific and historical texts, especially between the first and the second stage of the Early Modern English period (1500–1570 vs. 1570–1640). Referring to Bazerman’s (1988) work on the development of experimental reporting, Dorgeloh explains this decline by a general shift from narrative to argumentative organisation of scientific text:

While experiments moved “from any made or done thing, to an intentional investigation, to a test of a theory, to finally a proof of, or evidence for, a claim” (Bazerman, 1988, 65–66), the corresponding text forms apparently moved from “uncontested reports of events” to a more open kind of argumentation by way of “claims and experimental proofs” (Bazerman, 1988, 78): By the end of the 18th century, Bazerman finds that in scientific articles, although “a sub-series of experiments may be presented chronologically,” the overall structure was “based on the logical order of the claims to be proved” (Bazerman, 1988, 77). The experiment became “*part of* an argument,” with theory and claims “*hierarchically* and intellectually” dominating the experiment (Bazerman, 1988, 77–78; Dorgeloh’s emphasis). It was in this context that the usage of sentence-initial *And* became associated with the older, more narrative, and hence less professional style and thus became increasingly stigmatized. (Dorgeloh, 2004, pp. 1769–1770)

Translating this into the terminology of discourse relations, scientific writing of the Early Modern English period experienced increasing avoidance of *Narration*, presumably, in favour of discourse relations of the *Explanation* family, including *Evidence*.⁴⁰ Hence the shift from sentence-initial *and* associated with *Narration* to asyndetic connection associated with *Explanation*. According to

⁴⁰Cf. Chapter 2, pp. 25–27.

Dorgeloh (2004, p. 1761), “this foreshadowed, if not initiated, the more general banishment of initial *And* from larger parts of the written language,” to the effect that it practically stopped being used even in narratives. The corpus data of Modern English show almost negligible frequencies of sentence-initial *and*, not only in scientific prose, but also in e.g. memoirs. This suggests that the asyndetic connection in narrative sequences is, in a way, an artefact of the influence exerted by scientific writing on literacy. Since completion intonation is a stereotypical pattern for reading sentences ending in a period, the $U_1 (\searrow) U_2 (\searrow)$ pattern with *Narration* could therefore be an artefact of read speech.

Summarising, in this section I have argued that although previous empirical studies, as well as the intuitive coherence judgements reported in the pragmatics literature (cf. Chapter 2, pp. 16–21) suggest that asyndetic connection and *and*-conjunction are interchangeable in many discourse structural environments, particularly in discourses structured by *Narration*, there are enough reasons to view these findings as inconclusive with respect to the hypothesis proposed in Section 3.1. First, these studies did not pay systematic attention to intonation. An informal consideration of intonation in conversation fragments presented by Schiffrin (1987) suggests an interaction between conjunction and intonation which is thus far consistent with the proposed hypothesis. Second, the historical development of the written language has led to the establishment of asyndetic connection as the standard for *Narration*, which could have a certain impact on coherence judgements. In contrast to that, the observed high frequency of *and* in spoken narrative could be a symptom of more restricted usage of asyndetic connection with *Narration* in speech.

Of course, the alternative explanations proposed in this section call for systematic empirical testing which remains a task for future research. In the next section, I discuss further previous empirical work, which concentrated primarily on intonation, and which, in my view, sheds more light on the issue of the realisation options for implicit discourse relations in spontaneous speech.

3.2.2 Intonation and discourse relations in spontaneous speech

Most of the studies on the prosodic realisation of discourse structure so far have concentrated on the prosodic correlates of the hierarchical structure of discourse (abstract discourse constituency) rather than specific discourse relations.⁴¹ This applies to the distinction between utterance final pitch “falls” and “rises” as well. The by far better studied function of this distinction is signalling “completion” vs. “continuation” of a discourse constituent (the *structural* function), rather than signalling the distinction between the discourse relations *Restatement/Explanation* vs. *Narration/Continuation* (the *relational* function).⁴² However, there is one study—Nakajima and Allen (1993)—that addressed the relationship between utterance final pitch and groups of discourse relations similar to those considered so far. This section is devoted mainly to recapitulating the results of that study. In addition, a brief look will be taken at the study of Swerts and Gelykens (1994). Although they were primarily

⁴¹See Section 3.1.2, pp. 89–90, as well as Jasinskaja et al. (2004) for a more detailed survey.

⁴²Cf. the discussion in the previous section, pp. 108–109, and in particular the studies of Swerts and Gelykens (1994), Swerts et al. (1994), Swerts (1997).

concerned with the structural function of the rise/fall distinction, they make some relevant observations and remarks on the possible relationship between the structural and the relational function.

There are a couple of other studies that have searched for prosodic correlates of various classes of discourse relations. For instance, Mayer (1999) has observed an influence of the subordinating vs. coordinating distinction among discourse relations (*D-Dominanz*) on pitch range. Den Ouden, who used RST-based discourse annotations, found correlations between nuclearity (cf. nucleus-satellite vs. multinuclear relations) and articulation rate; the distinction between causal and non-causal relations affected a whole range of global prosodic features including pitch range, pause duration, as well as articulation rate; the distinction between “semantic” and “pragmatic” relations⁴³ had impact on pause duration and pitch range (den Ouden et al., 2000; den Ouden, 2004). However, these studies did not consider utterance final tunes, and moreover, they were based exclusively on read speech, so their findings will not be discussed in detail here.

Nakajima and Allen (1993)

Nakajima and Allen (1993) investigate a number of prosodic features in elicited spontaneous task-oriented dialogue with two participants. The participants are involved in a game, where the task of one participant, called “Human” (H) is to achieve a specific goal by making plans to manufacture and ship various goods to specified locations in the game’s world by the due date. The other participant, called “System” (S), has up-to-date information on the state of the world and assists H in making plans to achieve the given goal. The authors obtain about three hours of spontaneous dialogue.

The dialogue is further segmented into utterance units (UUs) and the transitions between consecutive utterance units are annotated with discourse relations. Nakajima and Allen use a simplified set of four relations: *topic shift*, *topic continuation*, *elaboration class* and *speech-act continuation*. The last two represent the relevant distinction. The *elaboration class* relations hold when “the current utterance adds some relevant information to the previous utterance” (Nakajima and Allen, 1993, p. 201). The definition is not very explicit, but judging by the examples they give, cf. (233) and (234), this transition type corresponds roughly to our notion of *Restatement*.

- (233) H: a. are there oranges available in warehouses in both cities H and I
S: b. uhh let’s see
there’re oranges available in uhh yes, in H and in city I
c. They have oranges in both places, enough for uhh uhm
several boxcars of oranges
- (234) H: a. let’s do that
b. let’s move E2 to city E

Speech-act continuation holds when “a single speech-act continues over several UUs.” The authors note that most of the speech-act continuations occur in “sequential conjunctions,” cf. (235). Note that speaker H presents a list of actions that should be taken one after the other, thus in our current terms, the

⁴³For example, causal relations between events, such as the causal *Explanation*, are semantic, whereas argumentative relations between propositions, e.g. *Evidence*, are pragmatic.

discourse relation between (235c) and (235d) could be analysed as *Continuation* or *Narration*.

- (235) H: a. now let's uhh
assume the oranges are already loaded into the boxcar B6
S: b. hnn-hnn
H: c. and we'll take the engine that's at city H
d. we'll move the boxcar with engine down to city A

Nakajima and Allen study a number of different prosodic features, among which the one most relevant for the current purposes is the utterance-final fundamental frequency. They find that the fundamental frequency at the end of an utterance preceding an *elaboration class* boundary tends to be *lower* than before a *speech-act continuation* boundary. This is consistent with the hypothesis that the $U_1 (\searrow) U_2 (\searrow)$ and $U_1 (\searrow) U_2 (\nearrow)$ patterns are associated with *Elaboration*-type relations, whereas $U_1 (\nearrow) U_2 (\nearrow)$ goes with *Narration*, *Continuation*, *Parallel*, etc., cf. Section 3.1.3.⁴⁴ Note that Nakajima and Allen only take the final F_0 of U_1 into account. Although they do not provide a phonological analysis and do not distinguish between utterance-final rising and falling pitch movements, they note that rising tones were the most typical contours at *speech-act continuation* boundaries, and they also found utterance-final falls from high to mid level in this position, which sounds reminiscent of continuation rises with a subsequent declining plateau. Both types of contours pulled up the mean final F_0 in *speech-act continuations* as compared to *elaborations*.

Of course, these findings can only be viewed as very preliminary support for the hypothesis proposed in Section 3.1. Gaining more conclusive results would require consideration of the connection modes between the consecutive utterances (asyndetic vs. *and* vs. explicitly marked), a phonological analysis of the different final pitch movement categories, as well as a more rigorous approach to the definition of the relevant discourse relation types. However, I believe that adding these extra dimensions and imposing additional restrictions on the material would only sharpen the associated prosodic contrasts.

Finally, it is interesting to note Nakajima and Allen's explanation for the observed tendency of *elaboration* to co-occur with low final F_0 , by which they try to establish a connection between the structural (completion vs. continuation) and the relational function (*elaboration* vs. *speech-act continuation*) of utterance-final pitch:

[...] This phenomenon can be explained by the semantic definition of elaboration class boundary and the pragmatic roles of prosody. At an elaboration boundary, the previous utterance UU_0 per se com-

⁴⁴Utterance-final F_0 also tends to be low at *topic shift* and *topic continuation* boundaries. However, since both kinds of relation presumably characterise pairs of utterances that are connected at a more global level of discourse structure, this finding does not falsify the current hypothesis which only applies to utterances connected most closely. As the name suggests, the utterances separated by a *topic shift* boundary presumably do not locally pertain to the same question under discussion. Moreover, Nakajima and Allen's study shows that *topic shifts* correlate with a pitch reset—a prosodic marker of discontinuity, cf. Section 3.1.2, pp. 89–90. The status of *topic continuation* and especially its distinction from *speech-act continuation* is less clear. Nakajima and Allen's intention is obviously to see *topic continuation* as a “looser” relationship than *speech-act continuation*, but we cannot say more on the basis of their characterisation.

pletes a particular statement, and the succeeding elaboration utterance UU_1 adds some relevant information to UU_0 . So the completeness of UU_0 leads to the final F0 lowering [...] (Nakajima and Allen, 1993, p. 203)

This observation can perhaps be interpreted as follows. For instance in (233), utterance (233b) by itself gives a complete, perfectly satisfactory answer to the Human's question, which is enough reason for it to be realised with a fall. Since the next utterance (233c) does not address a completely new question and since it cannot effectively contribute anything to the answer to the current question either (everything is already said by the preceding utterance), the only thing it can do is comment on the very same issue, state of affairs, event, already described by the previous utterance, *restate* it in a different way. In contrast, individual speech-act internal utterances do not achieve the communicative goal of that speech act—that is why they may introduce new states of affairs or events, as long as this is needed for the completion of the goal. Their inconclusive character with respect to the current issue under discussion is signalled by rising intonation. This idea will be developed in Chapter 4 and the whole rest of this dissertation, therefore it is worth mentioning another empirical study that independently arrived at a similar conclusion.

Swerts and Geluykens (1994)

The material of this study is elicited spontaneous monologues that consist of a series of instructions from a speaker to a listener whose task is to assemble the front view of a house from a set of ready-made pieces of cardboard (e.g. a roof, a front door, etc.). Due to the structure of the task, the monologues could be naturally segmented into “topic units” that corresponded to individual instructions dealing with a particular building block. The notion of discourse structure used in this study was based on this segmentation.

Among other prosodic features, Swerts and Geluykens investigate utterance-final boundary tones, in particular the opposition of low tones—accent-lending fall, followed by a low continuation (using the IPO-grammar of Dutch intonation, ‘t Hart et al., 1990, indicated by (\searrow) in the current notation)—and “non-low” tones (\nearrow), which consisted of accent-lending rise followed by high continuation; accent-lending rise, followed by half-fall, accent-lending rise followed by continuation rise, as well as accent-lending fall followed by continuation rise.

The study confirmed the hypothesis concerning the structural function of the low/non-low boundary tone opposition, i.e. that low tones are regularly associated with the end of a topic (i.e. instruction), whereas non-low tones serve to indicate that there is more to come on the same topic (i.e. the instruction is being continued). However, the most interesting observations concern the exceptions from this overall tendency. Swerts and Geluykens report that there were only 11 (out of 79 instances; 13,9%) high-ending contours in final position, whereas there are 15 (out of 45 instances; 33,3%) low-ending ones in non-final position. “In other words, while a high-ending contour almost invariably signals that an instruction has not ended, it is not the case that a low-ending one automatically implies instruction finality” (Swerts and Geluykens, 1994, p. 28). Most remarkably, Swerts and Geluykens observe an effect on inter-utterance

relations associated with low tones in “unexpected,” non-final position, and their explanation of this phenomenon goes in the same direction as Nakajima and Allen’s (1993):

[...] It appears that some instances of non-final low contours turn out not to be real counterevidence; looking at specific discourse contexts sometimes reveals that some of the apparent exceptions might be functionally motivated. For instance, some non-final low boundary tones occur at points where the information conveyed can be considered ‘complete’ from an informational point of view, i.e. sufficient to enable a listener to successfully execute the instruction of the speaker. However, as a sort of afterthought, there is a subsequent clause providing some details that are redundant from a purely informational point of view or that are so obvious or deducible from the previous discourse that they are not really necessary to be communicated. (Swerts and Geluykens, 1994, p. 28)

The above description strongly suggests that the occurrence of a completion fall in the middle of an instruction sometimes produced what in our terminology could be called a *Restatement* effect. Swerts and Geluykens (1994, pp. 28–29) illustrate this by (236), cf. the English translation in (237). Here “the first occurring low boundary (line (236e)/(237e)) is located at a position where the instruction is informationally complete. The subsequent utterance only *paraphrases* the semantic content of the previous part of the instruction” (Swerts and Geluykens, 1994, p. 29, my emphasis, line numbers are adjusted).

- (236) a. dan pakken we de voordeur (↗)
 b. en die zetten we rechts in het zwarte vierkant (↗)
 c. rechtsonder (↗)
 d. zodat de smalle kant van de voordeur
 tegen de onderkant van het zwarte vierkant aanzit (↗)
 e. en een klein stukje een centimeter of twee
 vanaf de rechterzijkant van het zwarte vierkant (↘)
 f. dus de onderkant van de voordeur loopt gelijk met
 de onderkant van het zwarte vierkant van de voorgevel (↘)
- (237) a. then we take the front door (↗)
 b. and we put that right in the black square (↗)
 c. at the bottom right (↗)
 d. so that the small side of the front door
 sits on the bottom side of the black square (↗)
 e. and a little bit, about two centimeters
 from the right side of the black square (↘)
 f. so the bottom side of the front door runs parallel with
 the bottom side of the black square of the front view (↘)

I also think it is symptomatic that this *Restatement* effect is observed primarily *within* an instruction, i.e. at a point where the occurrence of a completion fall is unexpected from the point of view of the demands of discourse constituency. As was emphasised in Section 3.1, the restriction of the U_1 (↘) U_2 (↘) pattern to be used with *Restatements* and *Explanations* is expected to apply primarily

to utterances that are connected most closely, i.e. form a discourse constituent and pertain to the same question under discussion at the most local level. Thus Swerts and Geluykens' observations support the importance of this condition.

Summing up, this section has discussed the findings of some previous empirical studies that are potentially relevant for the validity of the hypothesis proposed in Section 3.1. These results cannot be viewed as direct evidence for or against our hypothesis, since none of those studies has addressed the relevant problem directly. The research has concentrated either on discourse connectives without paying systematic attention to intonation, or on intonation, without considering connectives. Moreover, discourse relations, if considered at all, have not necessarily received the same definitions as those assumed in the present study. Therefore the hypothesised interactions in the way intonation and connectives affect the inference of implicit discourse relations have easily evaded the researchers' attention.

Nevertheless, discussing this work I have tried to motivate why the proposed hypothesis is not simply arbitrary and why it is worth pursuing. I have argued that the results of previous studies on discourse connectives in spontaneous speech, which at first glance cast doubt on the current hypothesis, should be reconsidered in the light of the findings concerning intonation. The relevant intonation studies in turn clearly corroborate the idea that "continuation rises" and "completion falls" correlate with different sets of discourse relations (*Narration/Continuation* vs. *Restatement/Explanation*, respectively) when used on utterances that are otherwise connected very closely in terms of discourse constituency. Furthermore, the researchers who looked at intonation, in particular Nakajima and Allen (1993) and Swerts and Geluykens (1994), see a natural connection between the structural function of falling tunes signalling completion, and their relational function signalling *Restatement*. This connection is, in my view, a key to a better understanding of the phenomenon of implicit discourse relations, and its specific aspects discussed in Chapter 2. This idea will be elaborated in Chapters 4–7.

Of course, the proposed hypothesis still needs empirical testing. Although the scope of the present study does not allow this, in this section I have offered some suggestions on where the relevant evidence could be found. Based on previous historical studies of the development of the written language, it was argued that the hypothesised contrasts between the $U_1 (\searrow) U_2 (\searrow)$ and $U_1 (\nearrow) U_2 (\nearrow)$ patterns in combination with asyndetic connection are not likely to show up in read aloud speech, where (i) the intonation is largely dictated by the punctuation, and (ii) the asyndetic connection has gained a different function than in the spoken language due to the suppression of sentence-initial *and*. Thus it is crucial to test the proposed hypothesis primarily on spontaneous speech.⁴⁵

Finally, an empirical assessment of the current hypothesis would necessarily require a reasonable phonetic/phonological interpretation of the (\nearrow) vs. (\searrow) opposition, which was characterised in purely functional terms in Section 3.1. Some preliminary ideas on this issue can already be drawn from Nakajima and Allen's (1993) and Swerts and Geluykens' (1994) studies that were discussed in this section. The next section addresses this question in more detail.

⁴⁵In Chapter 7, after developing a more elaborate picture of a theory of discourse interpretation in which the current ideas should be embedded, some further suggestions will be made regarding the possibility of using psycholinguistic experiments to test the proposed hypothesis.

3.3 Continuation and completion tunes

“Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, ‘and what is the use of a book,’ thought Alice ‘without pictures or conversation?’”⁴⁶ To please the demanding reader, in the previous section I cited some conversation. The main purpose of this section is to show some pictures.

More specifically, this section is to give an extended illustration of how (\nearrow) and (\searrow) are mapped to intonation patterns of a particular language, and what needs to be taken into account when applying the functional definitions of continuation and completion intonation given in Section 3.1.3. Some relevant general considerations are outlined in Section 3.3.1. The following Sections 3.3.2 and 3.3.3 work through a set of most likely candidates for (\searrow) and (\nearrow) in the intonational system of Russian.

3.3.1 General remarks

In Section 3.1.3, a completion tune was defined as one that is used to indicate a complete, exhaustive answer to a question, or a “closed” list of items. A continuation tune was taken to be a tune that communicates that the speaker has not finished his or her utterance, i.e. the utterance (so far) is *not* a complete answer. This definition is intended to be applicable to any language that signals this functional distinction by intonational means. In this section I only wish to comment on certain aspects of this definition, and address related methodological issues.

Firstly, the definition explicitly restricts the search for continuation and completion tunes to a single type of context—answers to questions. Since question answering is a practice characteristic of dialogue, it is implied that intonation patterns used in this type of discourse should be considered as candidates. If some intonation pattern does not normally occur in answers to questions in (spontaneous) dialogue, or if its usage in this context creates some very marked pragmatic effect (cf. e.g. Bolinger, 1978, p. 490, on down-drift in American English), then it does not qualify for either completion or continuation intonation in the relevant sense. Furthermore, “answers to questions” is intended to mean answers in the narrow technical sense, as specified in Section 3.1.1, i.e. declarative utterances congruent with the question. This is important because one and the same intonational opposition can signal different functional distinctions depending on the syntax of the sentence it is used on and its relation to the context; for instance, complete vs. incomplete answer in one case, and statement vs. question or question vs. continuation in another. Obviously, this restriction implies a much less general understanding of continuation/completion opposition than what is sometimes associated with these notions (cf. e.g. Cruttenden, 1981). This is an intended restriction, since this is the distinction that is expected to affect the inference of discourse relations as hypothesised in Section 3.1.

Secondly, our definition identifies a continuation tune as one signalling *speaker continuation* as opposed to *hearer continuation*. The former means that the speaker is going to continue talking, the latter means that the speaker is invit-

⁴⁶Lewis Carroll, *Alice in Wonderland*.

ing the hearer to continue. One rather prominent type of hearer continuation is a question—an active move by the speaker lending the floor to the hearer. Since both speaker continuations and questions are typically signalled by rising intonation (cf. e.g. Cruttenden, 1981), it has been argued that a more general overarching notion of continuation might be necessary for an adequate description of intonational meaning. Nevertheless, the current assumption is that within this overarching continuation category, speaker continuation is categorically distinct from hearer continuation, and that this distinction is explicitly signalled. Obviously, this must be so in order to guarantee the unproblematic flow of conversation, since the two types of continuation cause opposite interactive behaviour of the hearer—leaving the turn to the speaker in one case, and taking the turn in the other. Moreover, there is overwhelming evidence that prosody plays an important role in signalling this distinction (cf. e.g. Cutler and Pearson, 1986), and more specifically, that question rises are distinct from continuation rises (Caspers, 1998). On the other hand, systematic descriptions of the intonational systems of particular languages often mention (rising) patterns that characterise both speaker continuations and questions (Bryzgunova, 1980). However, this does not immediately imply that a particular utterance in a particular context that bears such an “ambiguous” intonation is itself ambiguous between speaker and hearer continuation. Prosodic features other than melody, as well as non-prosodic factors such as the syntax and the semantics of the utterance, as well as the context can play a disambiguating role (see Šafářová and Swerts, 2004, and references therein). Thus even if a particular intonation pattern indicates a question in some other type of context, but signals speaker continuation more or less unambiguously in answers to questions, this pattern will count for the current purposes as signalling speaker continuation, and thus satisfy the criterion for a continuation tune in the current narrow sense.

Thirdly, our definition of continuation and completion might create the impression that two *a priori* independent functional categories are being conflated: signalling speaker continuation vs. lack of such signalling on the one hand, and exhaustive vs. non-exhaustive answer on the other. In principle, one can imagine a language that has special prosodic marking for exhaustive answers that hold the turn, and non-exhaustive answers that lend the turn. In practice, however, it seems that these categories frequently correlate and are signalled by the same devices: turn-holding cues when used in answers to questions indicate non-exhaustiveness, whereas lack of such cues licenses an exhaustive interpretation of the answer. Should we find evidence for separate marking of exhaustivity and turn-taking, exhaustivity is more essential for the current notion of continuation/completion distinction—continuation intonation should then be identified as one that signals a non-exhaustive answer. However, as long as no such evidence is presented, these categories will be used interchangeably, and since the turn-taking function of intonation is much better studied and has been previously used in defining continuation and completion (cf. e.g. Gilles, 2005), I will mainly refer to that.⁴⁷

The above considerations suggest the following procedure for identifying continuation and completion intonation in a particular language. First, a corpus study of spontaneous dialogue has to be performed in order to find intonational

⁴⁷In Section 3.2.2, I distinguished between the structural and the relational function of intonation. Both turn-taking and exhaustivity are aspects of the structural function.

patterns that are normally used in answers to questions. Then, perception experiments should clarify which of these candidate patterns create strong biases for exhaustive (turn-final) or non-exhaustive (speaker continuation) interpretations in congruent question-answer pairs where the answer is constituted by a single utterance (cf. Section 3.1.1). We will leave this procedure for future research. The discussion of Russian continuation and completion tunes in Sections 3.3.2 and 3.3.3 is based entirely on the results of previous empirical studies which do not always provide a direct answer to all the relevant questions. Therefore the resulting selection of intonation patterns can only be viewed as preliminary, and is intended primarily as an illustration.

Finally, a few introductory words should be said on the formal correlates of continuation and completion, i.e. what constitutes a continuation or a completion *tune*. First of all, it should be noted that in some languages the relevant functional distinction might be expressed by means other than prosody, e.g. by particles,⁴⁸ but such cases will be ignored here. As is well-known, the prosody of an utterance is constituted by the suprasegmental features fundamental frequency, intensity and duration. All three features may play a role in signalling continuation and completion and will be referred to occasionally in the following sections; however, the focus of attention will stay on *tunes*—a subset of features of the F_0 track of an utterance. When talking about tunes, I will mainly use the vocabulary of the autosegmental-metrical approach to intonation (Ladd, 1996). The main assumptions of this approach are that intonation is constituted by a sequence of high and low tones (tonal targets), H and L, whose absolute height is constrained by the height of the top and the baseline of the speaker's range. The topline may undergo global and local manipulations, essentially, lowering from the beginning towards the end of a prosodic domain (global declination vs. local declination, or downstep). One of the most relevant features of intonation is the alignment of H and L tones with the segmental string. According to alignment, tonal morphemes are classified into *pitch accents* and *edge tones*.

Edge tones are associated with edges of a prosodic domain, especially the right edge. The most relevant prosodic domain is the intonational phrase (cf. fn. 2, on p. 79). In the current notation, edge tones will be marked by the diacritic “_”, i.e. H- or L-. Often a further distinction is made between “bigger” and “smaller” intonational phrases—intonational phrases in the narrow sense vs. intermediate phrases. Thus edge tones are classified into boundary tones T% associated with bigger phrases and phrase tones T- associated with smaller phrases. I will not to make any specific claims or assumptions regarding this distinction in Russian. The neutral term *edge tone* will be used instead, and the T- notation will be applied unselectively to all kinds of edge tones.

Pitch accents are aligned in the neighbourhood of metrically strong syllables. Which syllables are metrically strong depends, on the one hand, on the position of the lexical stress, and on the other hand, on phrasal stress which is a function of the syntactic and information structure of the phrase (cf. e.g. Selkirk, 1995). The metrically strongest syllable within an intonational phrase is said to bear *nuclear stress*, and the accent associated with it is called *nuclear accent*. Normally this is the last pitch accent in the intonational phrase. In the widely accepted ToBI notation, pitch accents are marked with the “*” diacritic,

⁴⁸A possible candidate is Japanese, where (complete) answers to questions invariably contain a copula *da*, *desu*. Such particles should then be counted (along with intonation) to the expression of completion in the current sense.

e.g. H*, L* (Silverman et al., 1992). If a pitch accent consists of two (or more) tones, the position of the star (H*L vs. HL*) indicates the alignment of the tonal targets with the stressed syllable. The starred tone is realised directly in the stressed syllable, whereas the other tones (trailing or leading tones) are aligned in its neighbourhood, e.g. on the post-tonic or the pretonic syllable.

The “tune” in the currently relevant sense is constituted by the sequence of tones and their alignment, as well as the local manipulations of the pitch range topline (downstep), whereas the most relevant portion of the tune for signalling continuation and completion in languages like Russian and English is the *nucleus*—the nuclear pitch accent plus the subsequent contour till the end of the intonational phrase, which usually depends on the presence of edge tones. For English, however, there has been a lot of effort in decomposing the meanings of nuclear tunes into more basic parts that can be assigned to individual tones (Pierrehumbert and Hirschberg, 1990; Bartels, 1999). Thus according to Bartels (1999, pp. 69, 77–78), “continuation dependence” is a function of just the H% boundary tone, though obviously a more abstract notion of continuation is meant here than just speaker continuation (cf. above). In this type of approach speaker continuation would have to be derived as a product of the compositional semantics of the tune put together from the meanings of individual tones and the pragmatic effects that come on top. Moreover, in continuation tunes that do not contain an H% boundary tone, e.g. L* H-L%, the continuation function would have to be analysed as an effect of “non-assertiveness” of H- (Bartels, 1999, p. 59). Our notion of completion in turn corresponds roughly to the combination of “assertiveness” assigned to L- and the lack of continuation dependence (L%) in Bartels’ theory. For the Russian tunes discussed in the next sections, no attempt of compositional analysis will be undertaken. The whole nucleus and sometimes even the whole tune including the prenuclear part will be considered as a meaning bearing unit. Similarly, continuation and completion will not be decomposed into more basic functions. Identifying the individual contributions of the tonal constituents of Russian continuation and completion tunes remains a task for the future.

3.3.2 Completion tunes in Russian

In our definition, “completion intonation” is an intonation pattern that is used on answers to questions and discriminates a complete from an incomplete answer, or a closed list from an open one. In this section I discuss some specific intonational patterns in Russian that can be regarded as the most likely candidates to match the functional criterion. According to previous descriptions of Russian intonation, “completion” is signalled by a falling pitch movement associated with the syllable bearing the nuclear stress, followed by low pitch on the post-tonic unstressed syllables. In terms of level tones, such tunes can be represented as a sequence of a falling pitch accent HL* or H*L and a low edge tone L-.

There exist at least two perceptually and functionally distinct options concerning the alignment of the falling pitch accent with the stressed syllable. This distinction will be referred to as *early fall* (HL*) vs. *late fall* (H*L), which corresponds roughly to IK-1 vs. IK-2 in Bryzgunova’s (1980) classification of “intonational constructions” (*intonacionnyye konstrukcii*, IK); type A vs. type B falls in Odé (1989); as well as falling intonation with neutral vs. “special” stress

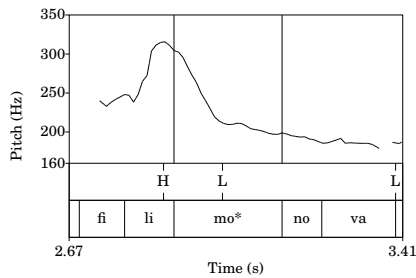


Figure 3.6: Early fall (IK-1)

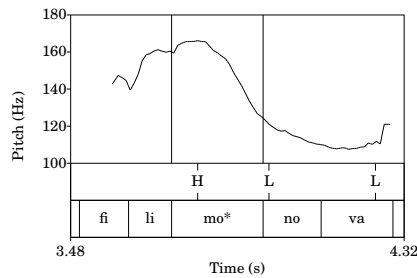


Figure 3.7: Late fall (IK-2)

in the characterisation of Svetožarova (1982, 1998). There are also some preliminary indications that the two types of fall in the nuclear position correlate with different pitch shapes of the prenuclear part of the intonational phrase, thus giving rise to two types of phrase level contours. To give a little preview, whereas the contour associated with the late fall seems to satisfy the current functional definition of completion intonation, the case is less clear with the early fall contour, therefore this opposition deserves closer attention.

The phonological opposition

Early and late falling pitch accents are illustrated in Figures 3.6 and 3.7, respectively. The pitch contours characterise two alternative realisations of a one word answer *Filimonova* (a proper name) in the context of a constituent question in (238), cf. the English translation in (239).⁴⁹ The vertical lines in the figures show the boundaries of the stressed syllable *mo* (marked with a star in the text tier below). In the realisation of the early fall, the high target H occurs in the pretonic syllable, whereas the low target L is reached well within the stressed syllable, somewhere around the beginning of the vowel, so the fall takes place largely on the onset consonant of the stressed syllable, cf. Figure 3.6. In contrast, the H target in Figure 3.7 is reached only in the stressed syllable, close to the beginning of the vowel, whereas the L target occurs no sooner than at the start of the post-tonic syllable, so the fall is aligned mainly with the stressed vowel. In the Pierrehumbert/ToBI style notation, the accents can be represented as HL* for the early vs. H*L for the late fall (cf. Alter, 1997).

- (238) A: Kto eto zvonil?
 who this called
 B: Filimonova (↘) .
 Filimonova

- (239) A: Who has just called?
 B: Filimonova (↘) .

The traditional descriptions of Russian intonation often consider two more

⁴⁹The utterances were obtained from Russian native speakers living in Moscow in the course of a small quasi-experimental reading study. The speakers read short stories that contained dialogue fragments like (238). Of course, it should be kept in mind that observations made on the basis of read speech cannot always be generalised to spontaneous speech.

features as essential in differentiating between the two falling accent types—intensity and pitch height (excursion). IK-2 (the late fall) is said to be associated with greater intensity than IK-1 (the early fall).⁵⁰ However, first of all, Svetozarova (1982, p. 114) points out that this contrast is neutralised if the accent occurs on the first word of a sentence where the intensity is generally high. Second, Odé’s study has cast doubt on the perceptual relevance of this feature. Intensity turned out to be a concomitant feature, but the difference between the two types of fall could be made audible by only changing the timing of the pitch movement (Odé, 1989, p. 42).⁵¹ In terms of pitch height, IK-2 (late fall) is also distinguished by a higher onset pitch than IK-1 (early fall). On the one hand, the smaller excursion of IK-1 could be a consequence of downstep with which it frequently co-occurs in multi-word intonational phrases, cf. below. On the other hand, Makarova’s (2003) study has shown that the height feature is also distinctive in one word phrases, which might be an indication of its independent phonological status. Moreover, the functional distinction studied by Makarova (“declarative” vs. “exclamative” sentence type) turned out to be primarily associated with pitch height, and only to a lesser extent with peak alignment.⁵²

When a falling nuclear pitch accent occurs at the end of a multi-word intonational phrase, additional contrasts are introduced by the realisation of its prenuclear part. The fall may or may not be preceded by prenuclear accents, and it may or may not be downstepped relative to some previous high tonal target (e.g. a high prenuclear accent or an initial high boundary tone %H), if there is one. Two contrasting patterns realised on a three-word utterance *Marina slušala muzyku* ‘Marina was listening to music’ are shown in Figures 3.8 and 3.9. The utterances were read aloud by two different speakers in the context given in (240), cf. the English translation in (241). The vertical lines in the figures indicate the boundaries of the stressed syllable bearing the nuclear falling accent.

- (240) A: Čem zanimalas’ Marina
 what.INSTR occupied herself Marina
 včera večerom posle užina?
 yesterday evening after dinner
- B: a. Marina slušala muzyku (↘) .
 Marina was listening to music
- b. Ona zanimalas’ svoim
 she occupied herself her.INSTR
 ljubimym delom (↘) .
 favourite.INSTR thing.INSTR

⁵⁰See e.g. Bryzgunova (1980, p. 107), Svetozarova (1982, p. 114), Svetozarova (1998, p. 266).

⁵¹It should be mentioned that Fougeron (1989) and after her Kodzasov (1996a, pp. 97–98) make a three-way distinction between an early fall (on the consonant), a late fall (on the vowel), and a neutral fall (on the consonant and the vowel). We shall return to this issue briefly in Section 3.3.3, p. 140.

⁵²Makarova’s (2003, cf. p. 93) phonological proposal thus makes the crucial distinction between H*L vs. !H*L patterns (if translated into more standard ToBI-style notation) rather than between H*L and HL*, as proposed by Alter (1997).

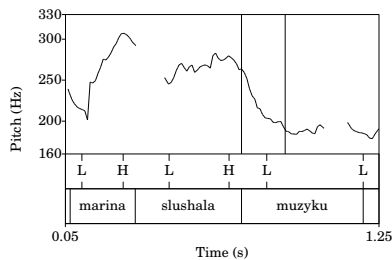


Figure 3.8: Downstepped early fall (IK-1) in a three-word phrase with two prenuclear pitch accents

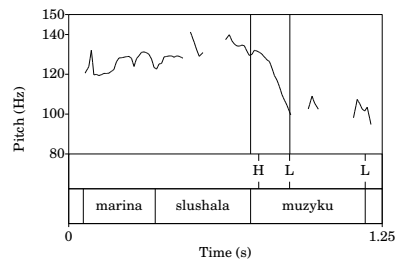


Figure 3.9: Late fall (IK-2) in a three-word phrase

- (241) A: What was Marina doing yesterday evening after dinner?
 B: a. Marina was listening to music (↘) .
 b. She was doing her favourite thing (↘) .

Interestingly, there appears to exist a certain correlation between the realisations of the prenuclear part and the nucleus. For instance, Svetozarova (1998, p. 266-267) points out that the falling nuclear accents of the first type (“neutral stress”) tend to be preceded by a sequence of prenuclear rising-falling pitch movements on almost every word, see Figure 3.8. Although she does not characterise the relevant falling pitch movement as an early fall, her description of the accent in terms of its effects on intensity and its “simple falling” shape suggests that roughly the same accent type is meant as Odé’s type A fall with early timing. Furthermore, Yokoyama (2001) mentions that the prenuclear accents as well as the nuclear fall typically undergo downstep in this type of contour, which is also supported by Mehlhorn’s (2002, pp. 151, 171) experimental study. Due to the rather expressed prenuclear pitch movements and the downstep, the nuclear fall is not perceived as being dramatically more prominent than the prenuclear accents (cf. Mehlhorn, 2002, p. 177).

In contrast, nuclear falls of the second type (“special stress,” late fall) frequently figure as the only pitch accent in the phrase, or perhaps there might be one prenuclear accent; in both cases, however, the prenuclear part of the phrase is realised with relatively flat intonation. If there is a prenuclear accent it has a much smaller excursion than the nuclear fall, and prototypically, no downstep takes place, cf. Figure 3.9. This gives rise to what Svetozarova calls a “strongly centralised” intonation contour where the nuclear accent expressly dominates the rest of the phrase in terms of prominence, cf. Svetozarova (1982, p. 111), Svetozarova (1998, p. 267), Mehlhorn (2002, pp. 156-157, 171).

The correlating prosodic features of the two Russian falling patterns are summarised in Table 3.3. It should be mentioned, however, that these correlations are certainly not perfect and upon closer inspection they will hardly turn out to be more than tendencies.⁵³ The strength of these tendencies has not been explored sufficiently yet by quantitative methods. Nevertheless, in the

⁵³For instance, the late fall can certainly be downstepped. However, the functional opposition between the late and the early fall after downstep does not seem to be the same as in the absence of downstep. In other words, even if there is no perfect correlation between the features in Table 3.3, there is certainly a complex interaction between them.

	Pattern 1	Pattern 2
alignment of the nuclear fall	early	late
intensity of the accented syllable	low	high
fall excursion	low	high
prenuclear pitch accents	on every word	one or none
downstep	yes	no

Table 3.3: Phonetic/phonological contrasts between the two prototypical falling patterns

rest of this section I will continue talking about the function of the two falling patterns as characterised by the whole combination of features. Teasing apart the contribution of each individual feature to “meaning” goes beyond the scope of the current study.

The functional opposition

When the falling intonation patterns described above are used on a full declarative sentence the pragmatic contrasts associated with the difference in intonation are rather subtle. For Makarova (2003) it is the distinction between the “declarative” and “exclamative” sentence type. Traditional descriptions usually say that Pattern 1 is typical for a “neutral” pronunciation of a declarative sentence, whereas Pattern 2 is “contrastive” or introduces “special emphasis” on the word bearing the nuclear accent.⁵⁴ Kodzasov (1996a, p. 98) characterises the late fall (Pattern 2) as signalling choice from a limited set of alternatives, in contrast to an open alternative set.⁵⁵ There are at least two ways in which one might be tempted to operationalise this distinction—broad vs. narrow focus, and “neutral” vs. corrective context. There is overwhelming experimental evidence for the relevance of both factors, so they must be very good approximations for the functional distinction between the two falling patterns. However, this is probably not the whole story yet, due to the following considerations.

Concerning the broad/narrow focus distinction, the production studies of Alter (1997) and Mehlhorn (2002, cf. p. 151) have shown a clear correlation of Pattern 1 with broad, and Pattern 2 with narrow focus. This is based primarily on the comparison of SVO sentences with the nuclear accent on the sentence-final direct object, uttered in the context of “broad” and “narrow focus” questions (cf. Section 3.1.1). In regard to the opposition of “neutral” vs. “contrastive” (corrective) focus, Mehlhorn’s (2002) results also suggest that Pattern 1 is associated with “neutral” focus, whereas Pattern 2 is used in corrections. However, there are also indications that this opposition is privative: whereas Pattern 1 might indeed be restricted to broad focus and non-corrective uses, Pattern 2 shows the standard broad/narrow focus ambiguity if the nuclear accent occurs in a projecting position, e.g. on the direct object (cf. e.g. Selkirk, 1995), and

⁵⁴See e.g. Bryzgunova (1980, p. 111), Svetozarova (1982, pp. 111–114), Svetozarova (1998, pp. 266–267).

⁵⁵Kodzasov attributes this function to the late fall, whereas Svetozarova sees “special emphasis” as an effect of the “strongly centralised” nature of the intonation contour, i.e. the absence or the low prominence of the prenuclear accents. Because of the correlations between these two features, the functional contrast is hard to locate.

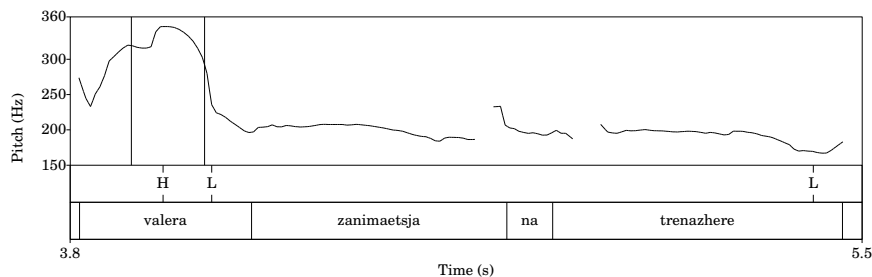


Figure 3.10: Pattern 2 (late fall) in an all new, broad focus utterance

is appropriate both in neutral contexts and corrections. First of all, note that Pattern 2 with broad focus is at least possible, e.g. the instance shown in Figure 3.9 was realised on an answer to a question of the type *What was Marina doing?* triggering broad focus on the VP, cf. (240)/(241). Second, Pattern 2 seems to be rather common in shortthetic sentences like *SOLNCE svetit/Svetit SOLNCE* ‘The SUN is shining,’ where the nuclear accent on the subject projects focus to the whole sentence. An example of such usage is given in (242)/(243), cf. Figure 3.10. Note also that it is rather unclear in what sense (242) could be understood as corrective, or contrastive in some broader sense. Speaker *B*’s answer presents a piece of brand new information, it is not contrasted with anything in the overt context, and it is not necessary that the interlocutors share a small set of possible sources of strange noises, of which Valera using the fitness machine is one. (Considerations like these apply generally tothetic sentences.)

- (242) A: Čto eto za strannyj zvuk?
 What this for strange sound
 B: VALERA (↘) zanimaetsja na trenazhere.
 Valera is working out on fitness machine

- (243) A: What is this strange noise?
 B: Valera is training on the fitness machine.

Of course, a single example does not falsify a regularity established in a quantitative study. However, the results of Mehlhorn’s (2002) perception experiments concerningthetic sentences, and in particular, their apparent discrepancy with the findings in production studies are remarkable in this connection. All three perception studies reported by Mehlhorn have shown thatthetic sentences with final position of the (nuclear-accented) subject behave like sentences with neutral focus, whereasthetic sentences with subjects in initial position pattern with contrastive focus sentences. Unfortunately, Mehlhorn does not give a detailed description of the prosodic patterns realised in the utterances that were used in the perception experiments. The utterances were all taken directly from the production study, and depending on the selection procedure may or may not have contained a certain amount of variation between Pattern 1 and 2. The results concerningthetic sentences raise the suspicion that those with sentence-final position of the subject were in fact uttered with Pattern 1, and those with sentence-initial subjects realised Pattern 2. If this was the case, then

first, it supports the hypothesis that Pattern 2 can be used to express broad non-contrastive focus; second, it suggests that the restrictions on the usage of Pattern 2 have more to do with the linear position of the nuclear accent. It seems that Pattern 2 is difficult to apply to long utterances with the nuclear accent in final position, which is understandable in the absence or with a small number of prenuclear accents which is typical for Pattern 2, cf. Table 3.3. This would also explain the dispreference for Pattern 2 in broad focus SVO sentences with the nuclear stress on the object in Alter's (1997) study. In sum, it seems that after all Pattern 2 is unmarked with respect to the broad/narrow and the neutral/contrastive focus distinction, whereas Pattern 1 is the marked element of the opposition, showing bias towards broad and non-contrastive focus.

Although the distinctions at the level of information structure discussed above must play a central role in the functional opposition between the two falling patterns, they probably do not exhaust what can be said on this account. The most interesting question and the one most relevant for finding out how well the patterns satisfy the current definition of completion intonation, is what determines the choice between Pattern 1 and 2 under conditions where both of them are more or less equally possible, i.e. in relatively short utterances in contexts that license broad focus. Some interesting observations were made by Bolinger (1978, p. 490) in connection with a similar pair of intonational patterns in American English. Bolinger points out that the sequence of accents with a "down-drift" (downstep, declination) is used, for instance, in story-telling where the speaker is granted the floor, e.g. (244).

(244) On^{ce} there was a be_{ar} His na^{me} was Smo_{ke_y} .

In contrast, the pattern where the last accent is highest in the phrase (higher than the prenuclear accents) "characterises sentences that make an emphatic appeal for acceptance" and is common in answers to questions, cf. (245). If the relative heights were reversed in (245), the answer would sound rude in its self-confidence.

(245) A: Why do you do that?

B: Because I want_{to} .

Something similar seems to be at work in Russian. Recall that Pattern 1 which is characterised by downstep is also characterised by the occurrence of prenuclear pitch accents on almost every word, whereas Pattern 2 is typically realised without or with one prenuclear accent of relatively low prominence, cf. Table 3.3. Kodzasov (1996b, pp. 196–197) suggests that accentuation of every word is typical for utterances that present events in a way such that "information is directly scanned from the reality." This definition would presumably apply to iconic representation of event sequences characteristic of narratives, and some of Kodzasov's examples suggest a narrative context. On the other hand, the high degree of prosodic structuring reflected by the strong prominence asymmetries in the realisation of the nucleus and the prenuclear part, and in particular, by the absence of prenuclear accents, characterises information "prepackaged into blocks." Kodzasov illustrates this case by answers to questions. In other words, it might be the case that Pattern 1 shows a certain affinity towards narrative, and Pattern 2 towards conversational contexts, and in particular, answers to

questions.

Yokoyama's (2001) observations concerning Pattern 1 ("neutral") intonation go in the same direction, moreover, they also suggest the characteristic usage of Pattern 1 in read speech.⁵⁶ She assigns it the function of imposing a *distant* mode of communication which is used in exchanges between interlocutors that are not on familiar terms, but she also points out that most instances of Pattern 1 in her data are taken from newscast readings or narrative, and that it is precisely read material where this intonation pattern is found in abundance (Yokoyama, 2001, p. 17). In contrast, various types of "non-neutral" intonation, which include Pattern 2 in our definition, are more frequent in informal conversation, and they are acquired earlier by children. On this basis, Yokoyama argues for the primacy and the unmarked nature of "non-neutral" intonation. Note that this is consistent with the above argument that Pattern 2 can be used with both broad and narrow focus, whereas the usage of Pattern 1 with narrow focus is more restricted.

The functional distinctions between the two Russian falling patterns are summarised in Table 3.4. Of course, the usage of these patterns requires more in depth (quantitative!) investigation. However, if the intuitions presented in the literature are right, even a superficial look suggests that Pattern 2 matches better the current definition of a completion intonation than Pattern 1. Recall that completion intonation has been characterised as one that is used on complete *answers to questions*. Although both falling patterns can be viewed as "final" in the sense that they do not signal continuation, Pattern 1 associated with the early fall does not seem to be the unmarked choice in question answering. Moreover, the tendency of this pattern to occur in read speech makes it a bad candidate for the study of pragmatic effects that are primarily expected to show up in spontaneous speech, cf. the discussion in Section 3.2, p. 119.⁵⁷ Therefore, when talking about the completion intonation in Russian, Pattern 2 will generally be meant; the $U_1 (\searrow) U_2 (\searrow)$ sequence then involves a repeated use of this pattern, illustrated in Figure 3.11 for the discourse (240)/(241). The same applies to languages that make a similar distinction by intonational means, e.g. American English, according to Bolinger (1978). The American English version of (\searrow) is assumed to be the pattern illustrated in (245)—presumably, $H^* L-L\%$ without downstep. The intuitions concerning the $U_1 (\searrow) U_2 (\searrow)$ and the $U_1 (\searrow) U_2 (\nearrow)$ sequences presented in Section 3.1.3 are related primarily to this intonation pattern.

3.3.3 Continuation tunes in Russian

Russian has a variety of intonation patterns that can indicate different sorts of "incompleteness," "continuation," and can be used in lists or continuing narrations. Most of these tunes have a rising portion, although the alignment of the rise with the segmental string can vary considerably. However, not all rising tunes in Russian signal incompleteness in answers to questions unambiguously,

⁵⁶Yokoyama (2001) identifies "neutral intonation" as $(LH)_n LH HL$, i.e. a sequence of one or more rises LH and a final fall HL, which normally undergo downstep.

⁵⁷Note that the uses of Pattern 1 in answers to questions shown in Figures 3.6 and 3.8 occurred in dialogues read aloud and might be partly due to the speakers' desire to read nicely instead of following instructions to produce the dialogue as naturally as possible. Previous experimental studies such as Alter (1997) and Mehlhorn (2002) that found Pattern 1 in answers to broad focus questions were also based on read speech.

	Pattern 1	Pattern 2
focus	broad	broad or narrow
discourse type	narrative	conversational
speech mode	read	spontaneous
communication mode	distant	close
acquisition	late	early

Table 3.4: Functional contrasts between the two prototypical falling patterns

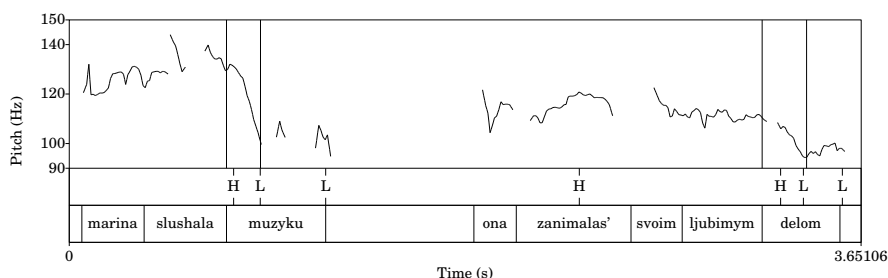


Figure 3.11: The U_1 (\searrow) U_2 (\searrow) pattern in Russian

and hence not all of them fit our definition of a continuation intonation. Candidates of both kinds are discussed below.

Rises to a high edge tone

To begin with, the falling patterns discussed in the previous section have variants with a slight rise after the nuclear fall, illustrated in Figures 3.12 and 3.13, cf. (240)/(241) above. In ToBI-style notation these could be represented roughly as sequences of a falling pitch accent HL^* or H^*L and a high edge tone $H-$, where the $H-$ is realised lower than the preceding high target (downstep, declination). Another pattern with a rise in the postnuclear part of the contour (or perhaps another realisation of the same pattern) is similar except that there is no high target associated with the stressed syllable, so the pattern could be represented as $L^* H-$, cf. Figures 3.14 and 3.15 showing the realisations of the words *ryba* ‘fish’ and *konfety* ‘candy’ taken from enumeration contexts in (246)/(247) and (248)/(249), respectively.⁵⁸ All these cases are classified as realisations of IK-4 by Bryzgunova (1980, pp. 114–117).

- (246) A: Čto segodnja na užin?
 what today for dinner
 B: Salat (\nearrow), ryba (\nearrow), i tvoi ljubimye pirožki (\searrow).
 salad fish and your favourite cakes
- (247) A: What do we have for dinner today?
 B: Salat (\nearrow), fish (\nearrow), and your favourite cakes (\searrow).

⁵⁸Examples (246) and (248) are taken from the audio materials to the textbook of Russian as a foreign language, Aksenova (2000).

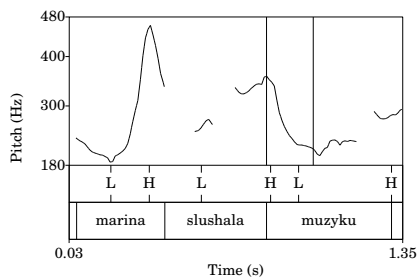


Figure 3.12: The falling Pattern 1 with a final rise (H-)

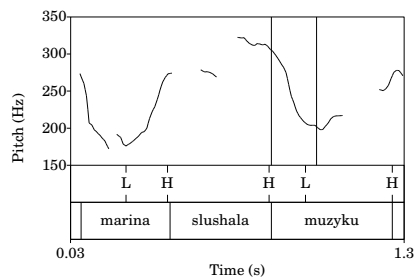


Figure 3.13: The falling Pattern 2 with a final rise (H-)

- (248) A: Čto nam nado kupit' ?
 what we.DAT necessary buy
 B: Ja dumaju čto nado kupit'
 I think that necessary buy
 cvety (↗) , tort (↗) , konfety (↗) , vino (↘) .
 flowers cake candy wine

- (249) A: What should we buy?
 B: I think we should buy some flowers, a cake, some candy, and wine.

As can be seen in Figures 3.14 and 3.15, the L target is aligned late in the stressed syllable, whereas the H target is anchored to the last syllable of the phrase. If there is more than one post-tonic syllable, the H sticks to the last one, so a gradual rise spans the whole postnuclear sequence, cf. Figure 3.16. (The boundaries of the stressed syllable are represented by vertical lines in the figures as usual.) On the other hand, if the postnuclear part gets really long, the H- target need not be realised at the very end of the intonational phrase, in which case it is followed by a gradually declining high plateau, cf. (250)/(251) in Figure 3.17, but even here, the peak is not reached immediately in the post-tonic syllable, but a few syllables later, so the rise still has a mild slope. This speaks for the analysis of the H target as an edge tone rather than a trailing tone belonging to the pitch accent, though the issue requires further investigation. Finally, if there is a high tonal target preceding the L*, the H- may or may not be downstepped relative to that target, cf. Figures 3.16 and 3.17.

- (250) A: Čto ty mne porekomendues' ?
 what you me will recommend
 B: Vanil'noe MOROŽENOE s ananasami (↗) .
 vanilla ice-cream with pineapples

- (251) A: What can you recommend?
 B: Vanilla ICE-CREAM with pineapple (↗) .

When this type of rising intonation is used on a declarative utterance in response to a question, it can indicate a non-final item of a list as in (246)/(247) and (248)/(249) above. However, it is also very frequently used at the end of a complete answer, in which case the final rise indicates hearer continuation—the

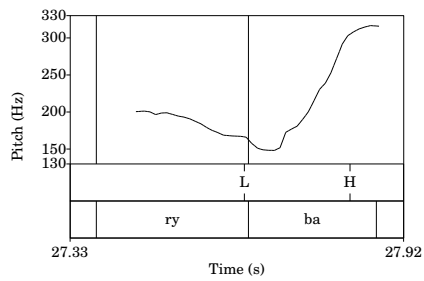


Figure 3.14: L* H- (IK-4)

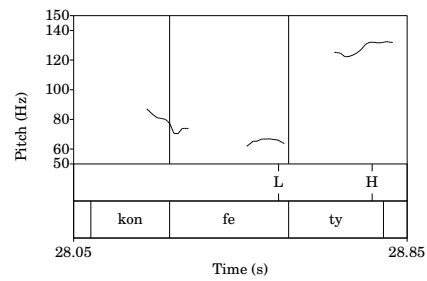


Figure 3.15: L* H- (IK-4)

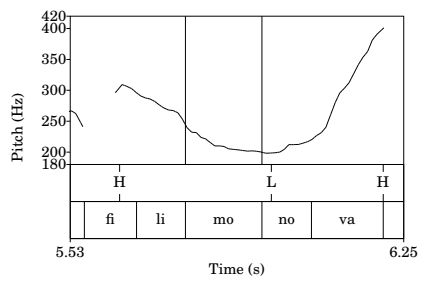


Figure 3.16: L* H- (IK-4) with late alignment of H-. One prenuclear H target, but no downstep.

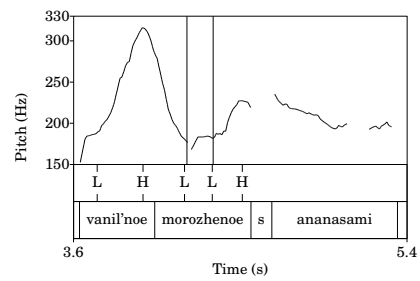


Figure 3.17: L* H- with early alignment of H-. One prenuclear H target; the H- is downstepped.

speaker is inviting the hearer to give some reaction to what has been said, cf. Bryzgunova (1980, p. 115), Kodzasov (1996a, pp. 91–92). In some contexts this can be interpreted as a kind of “challenge” to the hearer (Bryzgunova, 1984), in other contexts as an expression of surprise, participation, or friendliness. Examples of this usage are (250)/(251), as well as the realisations of (240)/(241) given in Figures 3.12 and 3.13. It remains to be clarified whether this intonation pattern is simply ambiguous between speaker and hearer continuation in the given type of context, and if it is, whether there are other prosodic features that disambiguate between the two functions; or whether the communication mode creates certain interpretation preferences. For instance, it has often been noted that using this pattern for speaker continuation is rather characteristic of the official style (cf. Bryzgunova, 1980, p. 115), whereas the “challenge” use is common in everyday conversation. This makes it not the best choice for a continuation tune in our definition.

Rising pitch accents

Another group of rising pitch movements is constituted by sequences of L and H targets where the H is part of the pitch accent. For instance, the non-final elements of the list in (252)/(253) are realised with a rise taking place in the accented syllable, cf. Figure 3.18. The L target is aligned around the beginning of the stressed syllable, sometimes already in the pretonic syllable; the H target is reached in the post-tonic syllable, followed by a relatively level high plateau realised on the subsequent unstressed syllables, if available. This type of rise is classified as type E by Odé (1989), and matches Bryzgunova’s (1980, p. 107) description of IK-6.⁵⁹ In terms of level tones, this accent could be represented as [LH]*. Because of some variability in alignment, it is difficult to place the star on one of the tones.

- (252) B: Včera ja byl na vystavke.
yesterday I was on exhibition
A: S kem ty byl?
with whom you were
B: Ja byl s Viktorom (↗) , Andreem (↗) ,
I was with Viktor Andrej
Annoj (↗) , i Mariej (↘) .
Anna and Maria
- (253) B: Yesterday I went to an exhibition.
A: With whom did you go?
B: I went with Viktor (↗) , Andrej (↗) , Anna (↗) , and Maria (↘) .

Another realisation of IK-6, which is, however, counted to a different category (type H/I accent) by Odé (1989), is shown in Figures 3.19 and 3.20, cf. (254) and (255), respectively. These realisations are obviously characterised by early alignment of the H target, as compared to the rises in Figure 3.18. However,

⁵⁹Sometimes, however, rises of this type are counted to the IK-3 category, apparently more on the basis of their function than phonology. For instance, the textbook by Aksenova (2000, p. 386), which uses Bryzgunova’s IK system for teaching intonation to Russian language learners, presents (252) as an example of IK-3. The inconsistency of Bryzgunova’s approach in using formal and functional criteria in identifying the intonational patterns has been noted e.g. by Keijsper (1983, pp. 104–106) and Odé (1989, pp. 43–44).

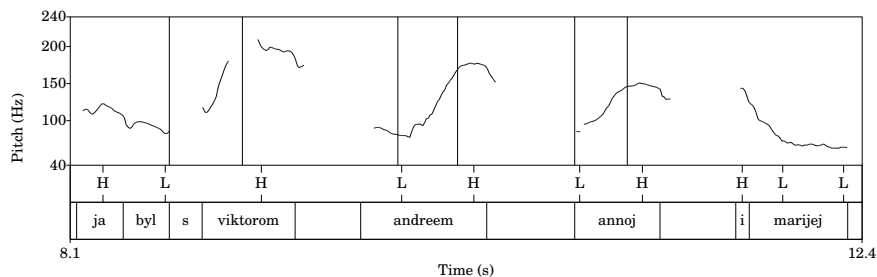


Figure 3.18: A rising pitch accent with a level high plateau on the post-tonic syllables, [LH]* H-, Odé's (1989) type E accent.

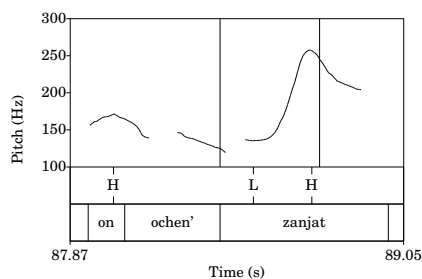


Figure 3.19: A rise with a plateau declining to mid-level, [LH]* !H-, Odé's (1989) type H/I accent.

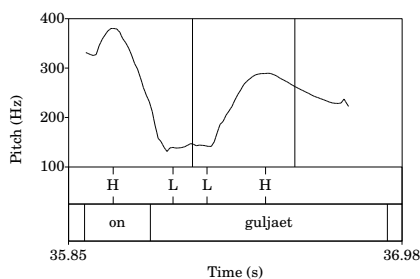


Figure 3.20: Downstepped rise with a plateau declining to mid-level, [LH]* !H-, Odé's (1989) type H/I accent.

according to Odé's results the most important distinctive feature between the two rising tunes is the pitch on the post-tonic syllables. Type H/I accents are identified by a more expressed decline of the postnuclear plateau down to middle height (Odé, 1989, p. 77). For lack of a better analysis, I will refer to the rise with a high plateau as [LH]* H-, and the rise with a mid-level plateau as [LH]* !H- (where ! indicates downstep as in the standard ToBI-notation).⁶⁰

(254) On očen' zanjat' (↗)

he very busy

He is very busy

(255) On guljaet (↗)

he walk.PRS.3sg

He is walking

When used on a declarative utterance in response to a question, rises of both types appear to signal speaker continuation more or less unambiguously. Although the issue needs to be studied more systematically by quantitative methods, previous qualitative observations all point out the continuation and

⁶⁰See Yokoyama (2001, p. 22) and Makarova (2003, pp. 92–93) for related ToBI-based proposals, though neither of them explicitly addresses the distinction in the postnuclear plateau level.

the listing function as the most prominent ones for these types of contour (Bryzgunova, 1980, p. 118). Although these contours can also be used to form an echo question, this interpretation is made highly implausible by the question-answer context—it is very unlikely that *Mary* (↗) be interpreted as an echo question in a context like: *A: Who ate the beans? B: Mary* (↗). In other words, [LH]* with both types of postnuclear plateau matches well the current definition of a continuation intonation (↗).

Nevertheless, it is interesting to note the functional distinction between these two types of rising tune, which was studied by Odé (1989, pp. 61–64) in a continuation test. The subjects listened to utterances or utterance fragments ending in one of the two rising tunes and were supposed to (a) write down an appropriate continuation, and (b) read the whole sequence aloud (the stimulus plus the proposed continuation). It turned out that rising accents with a level high plateau ([LH]* H-, type E) indicated that the final fall would follow soon. In particular, if the stimulus was a declarative main clause, the continuation was typically a single conjoined clause starting with *i* ‘and,’ which was then read by the subject with a falling intonation, e.g. *togda ja perestavil scenu* ‘then I directed the scene again’ (stimulus); *i stalo namnogo lučše* ‘and it became much better (continuation). In contrast, the accent with a plateau declining to mid-level ([LH]* !H-, type H/I) was in most cases followed by a rise of the same type, the continuations were typically asyndetic conjuncts, either followed by ‘...’ or a further conjunct with or without *i* ‘and’, e.g. *vse stali nervničat* ‘everybody got nervous’ (stimulus); *suetit’sja, obraščat’sja drug k drugu s nelepymi voprosami* ‘began to bustle, to ask one another absurd questions’ (continuation). This suggests that [LH]* H- rises are more likely to occur in closed lists (especially on the penultimate item of a closed list), whereas [LH]* !H- rises are more typical for open lists, or at least in positions where the list closure is not anticipated yet.⁶¹

In terms of schematic intonation patterns from Section 3.1.3, rises with a level high plateau are expected primarily in U_1 (↗) U_2 (↘) configurations, as well as in U_1 (↗) U_2 (↗) if it is followed by a completion U_3 (↘). An example of the latter kind is given in (256)/(257), cf. Figure 3.21. Rises with a plateau declining to mid-level are expected to occur in U_1 (↗) U_2 (↗) configurations, cf. (258)/(259) and Figure 3.22.

- (256) a. Oni podnimajutsja na eskalatore naverx (↗) ,
 they go up on escalator up
 b. vyxodjat na ulicu (↗) ,
 go out on street
 c. i sprašivajut kak projti na Puškinskuju ploščad’ (↘) .
 and ask how pass on Pushkin square
- (257) a. They take the escalator up (↗) ,
 b. go out into the street (↗) ,
 c. and ask how to get to Pushkin Square (↘) .

⁶¹ Apparently, a similar distinction is signalled in German by the presence vs. absence of downstep, cf. Selting (2003, 2004).

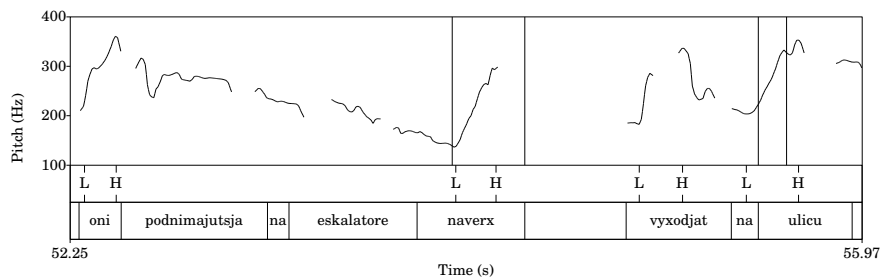


Figure 3.21: A realisation of the U_1 (↗) U_2 (↗) pattern in Russian: A [LH]* without a plateau (no post-tonic syllables), followed by an [LH]* H-, with a high level plateau.

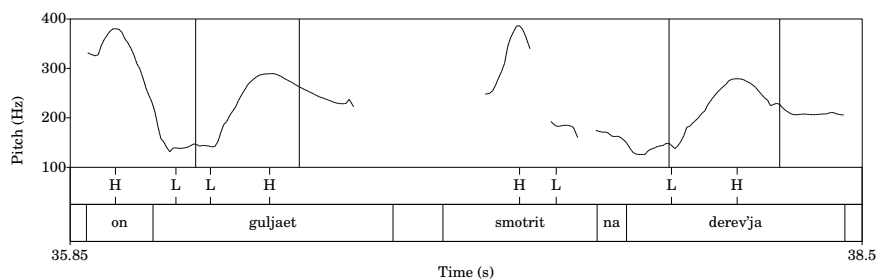


Figure 3.22: A realisation of the U_1 (↗) U_2 (↗) pattern in Russian: A sequence of two [LH]* !H-, with a plateau declining to mid-level.

- (258) a. Roman ždet ego v sadu (↘) .
 Roman is waiting him in garden
 b. On guljaet (↗) ,
 he is walking
 c. smotrit na derev'ja (↗) ...
 is looking at trees
- (259) a. Roman is waiting for him in the garden (↘) .
 b. He is walking (↗) ,
 c. looking at the trees (↗) ...

The rise-fall

Finally, one should mention the rising-falling pattern—Bryzgunova's IK-3 or Odé's type C tune—which is known for being so typically Russian. An instance of this pattern realised on the first conjunct of *B*'s answer in (260)/(261) is shown in Figure 3.23. The tune is characterised by a steep rise ([LH]* in the syllable bearing the nuclear stress, followed by an equally steep fall on the post-tonic syllables reaching the low reference line of the speaker, presumably targeting an L- edge tone, cf. Yokoyama (2001, p. 22), Makarova (2003, pp. 92–93).

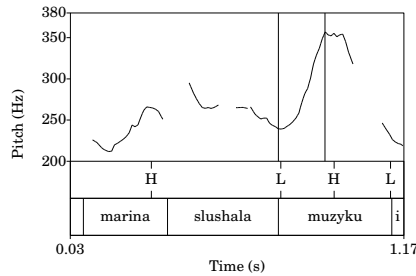


Figure 3.23: The rise-fall, [LH]* L-

- (260) A: Čem zanimalas' Marina
 what.INSTR occupied herself Marina
 včera večerom posle užina?
 yesterday evening after dinner
- B: a. Marina slušala muzyku (↗)
 Marina was listening to music
 b. i zanimalas' svoim
 and occupied herself her.INSTR
 ljubimym delom (↘) .
 favourite.INSTR thing.INSTR

- (261) A: What was Marina doing yesterday evening after dinner?
 B: a. Marina was listening to music (↗),
 b. and doing her favourite thing (↘) .

This intonation pattern can signal both speaker continuation and hearer continuation. As far as the latter function is concerned, the rise-fall is the pattern that distinguishes a *yes/no*-interrogative from a declarative sentence, whereas syntactic marking of interrogativity is not so commonly used in Russian. For instance, under the interrogative reading of the rise-fall, (260a) would be translated into English as *Was Marina listening to the music?* Although this is certainly a very prominent reading of this intonation pattern in general, it is not likely that real question/continuation ambiguity arises in the type of context we are interested in. A *yes/no*-question like *Was Marina listening to the music?* is simply very unlikely to occur in response to a *wh*-question *What was Marina doing?* for obvious pragmatic reasons, so the only way (260a) can be reasonably interpreted is that speaker *B* is answering the question, but has not completed his or her answer yet. In other words, [LH]* L- can be safely taken as another instance of continuation intonation (↗) in the current technical sense.

Unfortunately, Odé (1989) did not study this pattern along with other accentual rises in her continuation test, but according to my intuitions, [LH]* L- behaves like [LH]* H- signalling that a completion is coming soon, thus it is more likely to occur in a U_1 (↗) U_2 (↘) configuration, and be followed by a final conjunct starting with *i* 'and', as in (260) above, rather than by an asyndetic conjunct in an open list.⁶²

⁶²This functional similarity between [LH]* H- and [LH]* L- is possibly one of the reasons

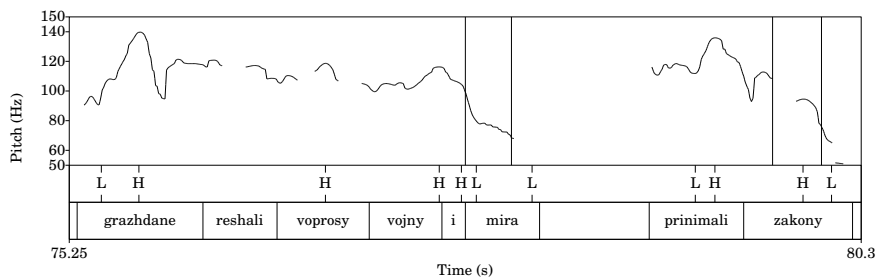


Figure 3.24: Falling intonation on non-final items of a list.

Lists with falling intonation

It is well-known that falling patterns like those discussed in Section 3.3.2 can be used on non-final list items, especially in open lists, cf. the discussion in Section 3.1.3, p. 99 (Bryzgunova, 1980, p. 115). An example is given in (262)/(263), cf. Figure 3.24. Here the first list item (262b) is realised with an early fall HL* L-, and the second (262c) with a late fall H*L L- (the boundaries of the accented syllables are indicated by vertical lines).⁶³ Note, however, that even in the latter case we are not dealing with a prototypical instance of Russian completion intonation since H*L L- is downstepped. It is not clear whether using H*L L- without downstep (Pattern 2 as defined in Section 3.3.2, cf. Figure 3.11) would make an equally coherent list.⁶⁴

- (262) a. Na etom narodnom sobranii
 at this popular meeting
 b. graždane rešali voprosy vojny i mira (HL* L-)
 citizens decided questions war.GEN and peace.GEN
 c. prinali zakony (H*L L-)
 accepted laws
 d. zaključali dogovory
 made treaties

- (263) a. At this popular meeting,
 b. the citizens decided on issues of war and peace,
 c. passed laws,
 d. made treaties.

This does not immediately imply, however, that these patterns should be counted to continuation intonation, for largely the same reasons as the rises to

why they were confused under the label of IK-3 in the early descriptions, although [LH]* H- does not satisfy the “official” phonological characterisation of IK-3, cf. fn. 59.

⁶³The example stems from the audiomaterials to Aksenova (2000, cf. pp. 425–426).

⁶⁴If a closer investigation reveals that H*L L- without downstep can be used felicitously on non-final list items, this would present, on the face of it, counterevidence to the hypothesis proposed in Section 3.1. However, as already mentioned (cf. fn. 34 on p. 100), falling intonation in lists generally creates an additional pragmatic effect of large number of items to be listed, at least in Russian (Kodzasov, 1996a, pp. 97–98), cf. similar observations by de Vries (2002, p. 214) on “emphasis” in lists in English. Section 6.7.1 in Chapter 6 presents some ideas on how such data could be reconciled with the current hypothesis.

a high edge tone discussed above. The main criterion is whether upon hearing a single utterance ending in H*L L- or HL* L- in response to a question, the hearer would take it as a full specification of the extension of the predicate addressed by the question (e.g. the predicate *P* for the question *Who P?*) or not. If so, i.e. if the utterance does not suggest that the speaker intends to hold the turn to, perhaps, add more items to the answer, then its intonation pattern is not an instance of continuation intonation. This issue requires more careful investigation. First of all, the question is how often the falling patterns H*L L- and HL* L- occur in unfinished lists as answers to questions in spontaneous dialogue, where the competition for the floor might impose additional restrictions on not signalling speaker continuation. If they do occur under such conditions, the second question is if the corresponding utterances contain some other prosodic cues that signal speaker continuation. Such cues might include a considerably shorter pause than one that normally follows a falling intonation, and possibly a relatively higher baseline of the overall pitch range of the utterance. Furthermore, Kodzasov (1996a, pp. 97–98) suggests that a particularly early fall (on the onset consonant) in contrast to a “neutral” fall (on the onset consonant and the vowel) indicates an item in an open list. Presumably, (262b) is an instance of this kind. However, the realisation of (262c) with H*L L- suggests that at least in read speech not only the early fall can occur in enumeration contexts.

In sum, even if falling intonation can occur on non-final list items in answers to questions, it is probably not the melody of the nucleus that signals that the speaker is not finished answering the question yet, but possibly some other prosodic features (if anything). Therefore, H*L L- and HL* L- in Russian will not be counted to continuation intonation patterns. Non-melodic signals of continuation will not be considered here.

3.3.4 Summary

In this section I have given an extended example of what it takes to map (\searrow) and (\nearrow)—completion and continuation intonation—to intonation patterns of a particular language. Only “ideal,” most uncontroversial instances were identified, i.e. intonation patterns that most felicitously occur in complete answers to questions and most unambiguously signal the completeness of the answer (for completion intonation), as well as intonation patterns that most unambiguously signal speaker continuation in the same type of context (for continuation intonation). The Russian prototype of (\searrow) is what was called Pattern 2 in Section 3.3.2: a H*L L- nucleus, large excursion of the fall, high intensity of the syllable bearing the nuclear stress, no or few prenuclear pitch accents, no downstep. The continuation intonation (\nearrow) in Russian is characterised by a rising pitch accent [LH]* which can be followed by a variety of realisations of the postnuclear part. If the hypothesis proposed in Section 3.1 is to be tested on Russian, these are the intonation patterns that are expected to correlate with different sets of discourse relations.

Of course, it should be kept in mind that this choice was made primarily on the basis of studies reported in the literature, which in turn are often based on informal qualitative observations. A systematic quantitative study might introduce some corrections to the proposed mapping. The considerations presented in this section should thus be viewed primarily as guidelines to such a study—a

set of issues to be taken into account in search for (\searrow) and (\nearrow) in Russian or any other language.

3.4 Concluding remarks

The most essential results of this chapter have already been summarised in Section 3.1.4, see esp. Table 3.2. Recapitulating briefly, pairs of asyndetically connected utterances U_1 and U_2 that form a discourse constituent and pertain to the same question under discussion were classified according to their intonation. I put forward the hypothesis that if both utterances bear an intonation characteristic of a complete answer to a question, $U_1 (\searrow) U_2 (\searrow)$, then there is a strong bias for the inference of *Restatement* or *Explanation*. If the semantics of the utterances is incompatible with these relations, the discourse is not perfectly coherent. With other intonational patterns this need not be the case. For instance, a sequence of continuation tunes, $U_1 (\nearrow) U_2 (\nearrow)$, allows for weaker semantic relations between the utterances, including *Narration* and simple listing.

Prosody plays a role at two levels in the proposed hypothesis: first in constraining discourse constituency (along with other markers of discontinuity, cf. Section 3.1.2); and second, in distinguishing complete from incomplete answers to questions. Due to the preoccupation of the previous work with written language, and even more with introspective coherence judgements which are presumably heavily influenced by the written norm, it is not surprising that the impact of prosody on discourse relations remained unnoticed. The dominating view has always been that *Narration* is among the most prominent readings for a sequence of asyndetically connected sentences without explicit relation markers, if not even the most prominent, default reading. In this chapter I presented a case for a much more differentiated view. First of all, I argued that due to the specifics of its historical development, the written language is different from the spoken language in this respect. Second, in spoken language the inference of *Narration* is expected to be sensitive to prosody in the way suggested by the proposed hypothesis: in $U_1 (\nearrow) U_2 (\nearrow)$ sequences it is among the possible candidates, however, in $U_1 (\searrow) U_2 (\searrow)$ sequences that form a discourse constituent and pertain to the same question, *Narration* is not only “not default,” it is dispreferred. A more natural expression of *Narration* with completion intonation in spontaneous speech requires the usage of *and* or other discourse markers: $U_1 (\searrow) . \textit{And} U_2 (\searrow) .$ Third, the role of discourse constituency and the QUD structure is not to be underestimated. Completion intonation occurring at a major structural break is probably not as informative about the implicit discourse relations between the constituents as completion intonation that occurs between utterances that are otherwise connected most closely. The *Restatement/Explanation* effect of the $U_1 (\searrow) U_2 (\searrow)$ pattern in combination with asyndetic connection is primarily expected to arise in the latter case.

As was emphasised many times, the above observations remain largely hypothetical and call for further empirical investigations. This task will not be pursued in the present study. Instead, the rest of this thesis is concerned with the question: if the proposed hypothesis is true, why is it true. I will develop a formal theory that is supposed to explain the bias for *Restatement/Explanation* associated with the combination of asyndetic connection and the $U_1 (\searrow) U_2 (\searrow)$

pattern. The relational function of the (\searrow) intonation is to be derived from its structural function of signalling completion. Some informal ideas of Nakajima and Allen (1993) and Swerts and Geluykens (1994) on this issue have already been presented in this chapter. In the next chapters, these ideas will be developed further.

Chapter 4

Restatement and exhaustification

The main outcome of the previous chapter is a hypothesis concerning possible implicit discourse relations in pairs of utterances that pertain to the same question under discussion and form a discourse constituent: if the connection between such utterances is asyndetic and both of them are realised with a completion intonation, $U_1 (\searrow) U_2 (\searrow)$, then the only discourse relations that can be drawn in the absence of explicit cues are *Restatement* and *Explanation*. In this and the following two chapters *Explanations* will be put aside, and I will concentrate on the question why *Restatement* has this preferential status.

In Chapter 2, I discussed two approaches to the interpretation of restatements proposed in the literature. As I tried to show, one of these approaches, the one based on SDRT (Asher and Lascarides, 2003; Danlos, 1999, 2001; Txurruka, 2003), provides a well-founded formal description to a whole range of relevant phenomena, but has to rely on a number of sometimes rather *ad hoc* stipulations. The other approach, based on Relevance Theory (Blakemore, 1987; Carston, 1993; Blakemore and Carston, 1999, 2005), tries to explain the phenomena in terms of general pragmatic principles of rational behaviour, but does so in a framework that has so far received no interpretation at a comparable level of formal rigour. Furthermore, both proposals pay little attention to the prosody of restatements. Focusing particularly on the prosodic considerations, in this chapter I will lay out some preliminaries to a pragmatic theory of restatement that is intended to combine the strengths of previous approaches—explanatory power and formal precision.

4.1 Introduction

Why should utterances that pertain to the same question and bear a completion intonation show a bias for a *Restatement* interpretation? I propose that the answer to this question follows essentially from the idea formulated by Zeevat (1994a) and developed in Jasinskaja (2004), namely, that utterances are interpreted as *exhaustive answers* to their respective questions under discussion. The connection is easy to see considering an example:

(264) What happened?

(265) Alena broke her skis (\searrow) .

She lost her main transportation means (\searrow) .

Suppose both utterances in (265) are interpreted as complete, exhaustive answers to the question in (264) *What happened?* The interpretation of the first utterance as a complete answer gives rise to the implicature that it specifies *all* the relevant happenings. Alena broke her skis *and that's all*, i.e. this is the only relevant event that happened. Similarly, the exhaustive interpretation of the second utterance implicates that Alena lost her main transportation means *and that's all*, i.e. that is also the only relevant event. But if both events are the only relevant event, then they must be the same event. Thus we get an *event coreference* effect in the terminology of Danlos (1999), a characteristic feature of *Particularisation* and *Generalisation* relations, which are special cases of *Restatement* in our current terminology, cf. pp. 97–103 in the previous chapter.

The next question is why this effect does not arise in conjoined sentences like (266a), nor in sequences of asyndetically connected sentences ending in continuation intonation (open lists), like (266b)? For conjunctions I adapt the idea proposed by Blakemore (1987) and Carston (1993) that conjoined sentences are processed as a single utterance. According to their proposal, which is cast in the framework of Relevance Theory, the interpretive contrasts between conjoined and asyndetically connected sentences are due to the fact that a conjunction of sentences fulfils the expectation of maximal relevance as a whole, whereas asyndetically connected sentences are processed separately, thus each has to reach maximal relevance on its own.¹ I will adopt van Rooy's (2003b) programmatic proposal to recast the relevance theoretic notion of relevance maximisation in terms of exhaustive interpretation. Thus in our terms what Blakemore and Carston's idea translates to is that a conjunction of sentences forms an exhaustive answer as a whole rather than each of the conjoined sentences separately. Therefore, Alena breaking her skis in (266a) is not the only relevant event that happened, neither is Alena losing her main transportation means. That is, nothing forces event coreference in this case.

(266) a. Alena broke her skis (\nearrow) ,
and (she) lost her main transportation means (\searrow) .

b. Alena broke her skis (\nearrow) ,
she lost her main transportation means (\nearrow) ...

The rising intonation on the first sentence in (266a) gives the hearer an on-line cue warning that the utterance is not yet complete, i.e. that it should only be interpreted in connection with the subsequent material (cf. Pierrehumbert and Hirschberg, 1990, on high boundary tones). In open lists like (266b), where a completion never follows, the continuation intonation can be taken to signal non-exhaustive interpretation: each of the list items names just one relevant happening, without implicating anything for the existence of other instances. The absence of exhaustivity again blocks the *Restatement* effect.

Exhaustive interpretation, also called *exhaustivization* or *exhaustification*, has been studied extensively in formal semantics and pragmatics. There exists a large number of formalisations, which usually consist in defining an operator

¹See Section 2.3.2 in Chapter 2 for a more detailed presentation.

that takes a normal, non-exhaustive meaning of an expression and returns its exhaustive meaning. Thus making the current proposal formally precise will largely boil down to applying the existing definitions of the exhaustification operator to the current problem. There are, however, a number of complications that make this task not as straightforward as it might seem at first glance. One of these complications has to do with the category that is to serve as input to exhaustive interpretation. Examples like (265) suggest that the whole sentence—a description of an event—is being exhaustivized with respect to the question *What happened?* However, most present-day theories of exhaustification deal with the exhaustive interpretation of NP answers to constituent questions, cf. (267) and (268), whereas questions “to a whole sentence” such as *What happened?* have received very little attention so far. Therefore, in order to be able to use exhaustification in the analysis of *Restatement* relations connecting whole sentences, one would first need to extend this mechanism to integrate sentence answers to sentence questions.

(267) Who snores?

(268) John.

But suppose we have done this and we have a notion of exhaustification in our hands that can deal with answers to both the usual constituent questions and *What happened?* questions. If it is the same exhaustification mechanism that applies in both cases, and if the general proposal outlined above is correct, then we would expect to find restatement effects in NPs, too. The example in (270) suggests that this is a correct prediction. Since the exhaustive interpretation of NPs is indeed currently much better understood than the exhaustification of other categories, “nominal restatements,” such as (270a), could serve as a perfect test bed for the general idea of analysing restatements in terms of exhaustification.

(269) Who snores?

(270) a. John (\searrow) . My best friend (\searrow) .
 b. John (\nearrow) and my best friend (\searrow) .

However, before we jump to quick conclusions, the matter has to be studied more carefully. Discourses like (270a) are traditionally analysed as instances of *nominal apposition*, which is normally viewed as an intrasentential phenomenon. Although the apparent parallelism between nominal appositions and discourse level restatements (elaborations) has often been noted (see e.g. Burton-Roberts, 1999; Txurruka, 2003, p. 282), some facts and observations discussed in other studies e.g. Potts (2005) suggest that there are both similarities and differences between these two phenomena, so the analogy might not be that good after all. Nevertheless, I believe that this analogy is a helpful one as long as the facts pertaining specifically to apposition are not mixed with the properties of restatements. Section 4.2 provides a detailed discussion of the relevant distinctions, and more generally, the relationship between nominal apposition, nominal restatement and canonical sentential restatement. Section 4.3 then puts the proposed ideas in a broader context of the current research on exhaustification and prepares the ground for the formal analysis developed in Chapters 5 and 6.

4.2 Restatements

This section studies the phenomenon that we will call “nominal restatement” and its relationship to nominal apposition on the one hand, and canonical sentential restatement on the other. Nominal restatement is a sequence of two NPs (or DPs),² that (a) both constitute an appropriate congruent short answer to a constituent *wh*-question; and (b) are “co-extensional” or “corefer”, although “coreference” will be understood quite broadly here. In addition to the standard cases of referring expressions that denote the same individual or group, coreference will apply to indefinites and quantified expressions. For instance *Mary* and *a linguist* will be assumed to corefer whenever Mary belongs to the set of linguists, and *a linguist* does not introduce a discourse referent distinct from Mary.³ A universally quantified expression like *every linguist* will be assumed to corefer with *Mary, John, and Bill* iff the set of all linguists is the set containing Mary, John and Bill and no one else.

An example of an nominal restatement based on a standard coreference relation is shown in (271), adapted from Burton-Roberts (1975, p. 391).

- (271) a. Who returned to London?
b. Sterne. The author of Tristram Shandy.

As already mentioned, such sequences of coreferring NPs can also be classified as nominal appositions. What distinguishes nominal restatements within the class of nominal appositions in general, is that they are formed by two independent utterances, which is made possible by the presence of a question, whereas appositions can be embedded in a single sentence, cf. (272).

- (272) Sterne, the author of Tristram Shandy, returned to London.

But is nominal restatement a special case of nominal apposition? This is largely a matter of definition of nominal apposition and depends on the set of syntactic and semantic properties attributed to it, which is not a matter of perfect consensus. Nominal restatements would probably be subsumed under e.g. Burton-Roberts’ (1975; 1999) notion of nominal apposition, but they are rather different from the construction studied by e.g. Potts (2005) under the same label—the most comprehensive formal analysis of nominal apposition to date. Section 4.2.1 reviews some relevant properties of nominal restatements by comparing them to appositions in Potts’ sense. Section 4.2.2 then compares nominal restatements to canonical sentential restatements. I will argue that the parallelism between the latter two motivates a uniform treatment, thus nominal restatements indeed present suitable material for testing the proposed exhaustification-based analysis of restatement in general.

4.2.1 Nominal restatements vs. nominal appositions

In this section I consider a selection of features of nominal appositions discussed by Potts (2005) as a basis for comparison between nominal appositions and nominal restatements. Although there are some striking similarities between

²The distinction between NPs and DPs is irrelevant for the current discussion. The more theory-neutral term NP will be used for both types of constructions.

³In this broad sense, coreference holds even when the indefinite is used in predicative function as in *Mary is a linguist*.

the two phenomena, there are also a number of essential differences. I will concentrate especially on the differences.

When talking about nominal appositions I will adopt the terminology of Huddleston et al. (2002), and refer to the syntactic head and the left member of an apposition, e.g. *Sterne* in (272), as the *anchor*. The right member, surrounded by commas in writing and presumably by prosodic breaks in speech, will be called *appositive*, e.g. *the author of Tristram Shandy* in (272). For convenience the same terminology will be occasionally used for the left and the right part of a nominal restatement, although this is not quite correct, since parts of restatements are arguably not connected by syntactic relations.

Case marking

Case marking is a feature on which nominal appositions and nominal restatements converge. In appositions the anchor and the appositive share case (cf. Potts, 2005, p. 107), which becomes evident especially in languages with rich case marking such as German and Russian:

(273) Ich sah meinen Freund, den Pfarrer.
 I saw my.ACC friend the.ACC parson
I saw my friend, the parson.

(274) Valera napisal pis'mo Marine, svoej sestre.
 Valera wrote letter Marina.DAT his.DAT sister.DAT
Valera wrote a letter to Marina, his sister.

The same holds for nominal restatements, for obvious reasons. Since both parts of a restatement must be a congruent answer to the question, and congruence in particular involves “agreement” of the answer with the *wh*-phrase, cf. p. 81 in Chapter 3, both answers necessarily inherit the same case from it.

(275) Wen sahst Du?
 Who.ACC saw you
Whom did you see?

(276) Meinen Freund. Den Pfarrer.
 my.ACC friend the.ACC parson
My friend. The parson.

(277) Komu Valera napisal pis'mo?
 who.DAT Valera wrote letter
Who did Valera write a letter to?

(278) Marine. Svoej sestre.
 Marina.DAT his.DAT sister.DAT
Marina. His sister.

Adjacency

Potts (2005, p. 104) points out that appositives must be immediately adjacent to their anchors. Again, this is a necessary property of a nominal restatement since it does not contain any material except the “anchor” and the “appositive,” thus nothing can intervene between them. It should be noted, though, that if we

take restatements in a broader sense so they also include mixed S/NP cases such as (280), it becomes clear that adjacency is not required for the coreferring NPs. Thus in (280) *the famous cyclist* refers to Lance, although John is immediately adjacent.⁴

(279) Who is talking to John?

(280) LANCE is talking to John. The famous CYCLIST.

Looking at (280) alone, the generalisation appears to be that the coreference relation is established between the focused phrases. Given a question, it is clear that coreference is established between the NPs that answer it.

Right adjunction

Potts (2005, pp. 106–107) proposes that nominal appositives are right-adjoined to their anchors. One of his arguments is the apparent absence of such constructions in languages that forbid right adjunction categorically, e.g. Turkish or Japanese. The closest construction in Turkish is a left-adjoining version, illustrated in (281), similar to the English *the bicyclist Hasan*. Note that the NP *ünlü bisikletçi* ‘the famous bicyclist’ does not copy the case marker *-la*, cf. *Hasanla* ‘Hasan.’

(281) Ü-n-lü bisiklet-çi Hasan-la yarış-tan önce konuş-tu-k
 fame-ous bicycle-ist Hasan-with race.ABL before speak.PAST-we
We spoke with Hasan, the famous bicyclist, before the race.

However, nominal restatements are available both in Turkish and Japanese which suggests that they are not dependent on right adjunction. The examples below look entirely like nominal restatements in English, German and Russian: the case marking is the same on both NPs. Furthermore, the ‘famous bicyclist’ and ‘Hasan’ in the Turkish example, as well as ‘the mayor of Tokyo’ and ‘Ishihara Shintaro’ in the Japanese example are interpreted as referring to the same individual, so these are not lists either.⁵

(282) Kim ile siz konuş-tu-nuz ?
 who with you.2PL speak-PAST-2PL
With whom did you speak?

(283) a. Ü-n-lü bisiklet-çi-yle. Hasan-la.
 fame-ous bicycle-ist-with Hasan-with
With the famous bicyclist. With Hasan.
 b. Hasan-la. Ü-n-lü bisiklet-çi-yle.
 Hasan-with fame-ous bicycle-ist-with
With Hasan. With the famous bicyclist.

⁴It is not clear if Potts (2005) assumes non-adjacent appositives that appear at the end of the sentence to be ungrammatical. It is clear though that he does not treat them as instances of nominal apposition (cf. Potts, 2005, p. 104). By contrast, for Burton-Roberts such cases are obviously first class citizens among nominal appositions, cf. Burton-Roberts (1975, p. 417), Burton-Roberts (1999, p. 25).

⁵In the Japanese restatements (285) the NPs appear with a copula *desu*. Such particles are obligatory in answers to questions, thus *Tokyo totizini* without *desu* would not be a well-formed short answer. In the current setting, *desu* can be viewed as part of the completion marking of the answer, cf. fn. 48, on p. 122, Chapter 3.

(284) Taro-ga dare-ni atta-no ?
 Taro-NOM who-DAT meet-Q
Whom did Taro meet?

(285) a. Tokyo totizi-ni desu. Ishihara Shintaro-ni desu.
 Tokyo mayor-DAT COP Ishihara Shintaro-DAT COP
The mayor of Tokyo. Ishihara Shintaro.
 b. Ishihara Shintaro-ni desu. Tokyo totizi-ni desu.
 Ishihara Shintaro-DAT COP Tokyo mayor-DAT COP
Ishihara Shintaro. The mayor of Tokyo.

Quantifiers and scope

Both nominal appositions and nominal restatements interact in interesting ways with quantification and scope relationships. Here is a brief and very partial comparison of their behaviour specifically with regard to quantifiers.

Quantifiers as anchors and appositives: According to Potts (2005, pp. 122–125, 131), quantified expressions are neither good anchors nor good appositives. He illustrates the latter by examples like (286).

(286) *We spoke with Tanya, Ashley, and Connie, every secretary in the department, about the broken printer.

A careful look at nominal restatements shows that they are different in this respect. The following answers are all more or less acceptable, and the NPs corefer in the current broad sense. In (288a) and (288b) the thirteen individuals who got their travel costs reimbursed *are* all those who submitted their application in time. Similarly in (288c) and (288d), the group of all timely applicants is identical with the group of persons listed.

(287) Who got their travel costs reimbursed?

(288) a. 13 employees. Everyone who submitted their application in time.
 b. Every employee who submitted their application in time. 13 people.
 c. Jones, Jackson, Armstrong, Mason, Smith, Williams, and Lee.
 Everyone who submitted their application in time.
 d. Everyone who submitted their application in time.
 Jones, Jackson, Armstrong, Mason, Smith, Williams, and Lee.

It is also true for nominal restatements that the usage of quantifiers undergoes severe constraints, however, these constraints seem to have mostly pragmatic nature. In the Russian example below, the answer becomes more and more acceptable the longer the list of applicants. The same seems to be the case in English. This can easily be explained by the fact that both parts of a restatement have to constitute an appropriate answer to the question in the given context. If there is only one person who got their travel costs reimbursed, as in (290a), one would hardly ever use a complex universally quantified description to state this fact. Speaking in Relevance theoretic terms, identifying the person by such a description puts a high processing load on the hearer, as compared to just naming that person, given that the speaker knows and is willing to share that information. As the list grows in length it becomes harder to process, so identification by description pays off after a certain point.

- (289) Komu oplatili komandirovočnye rasxody?
 who.DAT payed.PL travel.ACC costs.ACC
Who got their travel costs reimbursed?
- (290) a. # Každomu kto vovremja podal zajavlenie.
 everyone.DAT who.NOM in time submitted application.ACC
 Ivanovu.
 Ivanov.DAT
Everyone who submitted their application in time. Ivanov.
- b. ?? Každomu kto vovremja podal zajavlenie.
 everyone.DAT who.NOM in time submitted application.ACC
 Ivanovu i Petrovu.
 Ivanov.DAT and Petrov.DAT
*Everyone who submitted their application in time.
 Ivanov and Petrov.*
- c. ? Každomu kto vovremja podal zajavlenie.
 everyone.DAT who.NOM in time submitted application.ACC
 Ivanovu, Petrovu i Sidorovu.
 Ivanov.DAT Petrov.DAT and Sidorov.DAT
*Everyone who submitted their application in time.
 Ivanov, Petrov and Sidorov.*
- d. Každomu kto vovremja podal zajavlenie.
 everyone.DAT who.NOM in time submitted application.ACC
 Ivanovu, Petrovu, Sidorovu, Kuznecovoj,
 Ivanov.DAT Petrov.DAT Sidorov.DAT Kuznecova.DAT
 Nikitinoj i Makarovoj.
 Nikitina.DAT and Makarova.DAT
*Everyone who submitted their application in time.
 Ivanov, Petrov, Sidorov, Kuznecova, Nikitina and Makarova.*

The phenomenon illustrated above is just one of many ways in which pragmatics can affect the quality of a nominal restatement involving quantifiers. In general, such restatements are felicitous only if both the quantified and the (in)definite answer (in the order they occur) contribute to “making the point” in the given context. However, contexts that make this possible are relatively rare and marked, therefore, restatements with quantifiers often appear ill-formed.

Scopelessness: It is an old observation, also discussed by Potts (2005, pp. 114–115), that nominal appositives are semantically unembeddable—they are always interpreted outside the scope of any operators occurring in the sentence, and they do not take scope over anything beyond themselves. Restatements are similar in the sense that one part of a restatement never takes scope over the other. Thus the universal quantifier in (292) cannot be interpreted as taking scope over the indefinite, i.e. ‘every climber who is an experienced adventurer’ (as opposed to the unexperienced ones) is not among the possible readings. The reading where there is exactly one climber and (s)he is an experienced adventurer is dispreferred for the same pragmatic reasons as in (290a) above, therefore the restatement is altogether infelicitous.⁶

⁶Potts (2005, see pp. 122–123, 131–133) accounts for appositions similar to (292) with a general prohibition of quantifiers as anchors or appositives.

(291) Who took the best equipment?

(292) a. # Every climber. An experienced adventurer.

b. # An experienced adventurer. Every climber.

However, nominal restatements are again different from nominal appositions in Potts' sense as the answers that constitute a restatement can be bound by operators occurring in the question.

(293) Who did every student meet with?

(294) Her supervisor. The professor overseeing her research.

(295) What did most children wish for a pet?

(296) A dog. A German shepperd.

Similarly, quantifiers in restatements can take scope over variables in the question. An example is (287)/(288) discussed above. In other words, nominal restatements, unlike appositives, are not completely scopeless.

Coordination vs. asyndetic connection

Finally, one should mention one rather important feature that nominal appositions and nominal restatements also share—they are both semantically distinct from (explicitly marked) coordination, and instead exhibit an affinity with separate asyndetically connected sentences, cf. Burton-Roberts (1999, p. 27), Potts (2005, pp. 198–200). Moreover, the following statement generally appears to hold for both types of construction:⁷

(297) Asyndetic connection between NPs, i.e. absence of a coordinating conjunction or other explicit marker of connection, correlates with coreference (in the current broad sense), i.e. with the appositive/restatement reading.

This generalisation will be discussed in more detail in Section 4.2.2, since this is the property of both nominal and sentential restatements that is in focus of the present study. Here I will only mention some related observations concerning nominal appositions, as well as some exceptions from this rule, which, however, once again reveal parallelism between nominal appositions and nominal restatements.

The semantic distinctions between (asyndetic) apposition and coordination were emphasised, for instance, by Burton-Roberts (1999, p. 27). He points out that (298a) denotes a single individual, i.e. *Olsen* and *the First Mate* “corefer,” whereas (298b), where the NPs are coordinated with an explicit conjunction, denotes a group of two individuals.

(298) a. Olsen, the First Mate

b. Olsen and the First Mate

If the NPs denote groups, asyndetic connection requires strict coreference; inclusion of one group in the other is not enough. This property was discussed, in particular, by de Vries (2002, p. 212). He points out that *for example* and

⁷The assumption behind (297) is that asyndetically connected lists are excluded in some way, for instance, on intonational grounds along the lines of Chapter 3.

especially cannot be felicitously left out in the following examples, since the NPs are incompatible with a strictly coreferential reading.

- (299) a. Many people, *for example* my neighbour, like the mayor.
 b. They liked these books, *especially* “De avonden”.

- (300) a. # Many people, my neighbour, like the mayor.
 b. # They liked these books, “De avonden”.

It should be mentioned that for Potts (2005) the relationship between the appositive and the anchor involves predication, rather than coreference in any sense of the term. That is, the appositive is a predicate, and the anchor is its argument, so an apposition like (298a), would be interpreted as *first mate(Olsen)*, ‘Olsen is the First Mate.’ For simple cases like (298a) this amounts to largely the same semantic consequences as a characterisation in terms of coreference in the current broad sense.⁸ Thus Potts (2005) would account for the facts illustrated above using this functional application mechanism. Since ‘Many people is/are my neighbour’ is semantically out, (300a) would be predicted to be ill-formed, too.

There is a prominent class of exceptions to this general rule that concerns both appositions and nominal restatements. For instance, (302b), where the second NP is quantified by a numeral, is much more acceptable than (302a), and is understood as involving an inclusion relation, that is, three linguists snore and two of them are phonologists. The Russian equivalent of (302b), given in (304b), is perfectly well-formed according to my intuitions.

(301) Who snores?

- (302) a. # Three linguists (\setminus) . John and Mary (\setminus) .
 b. ? Three linguists (\setminus) . Two phonologists (\setminus) .

(303) Kto xrapit?
 who snores

- (304) a. # Tri lingvista (\setminus) . Valera i Marina (\setminus) .
 three linguists Valera and Marina
 b. Tri lingvista (\setminus) . Dva fonologa (\setminus) .
 three linguists two phonologists

Apparently, the contrast in (302) and (304) indeed has to do with the choice of a quantifier. In particular, the numerals appear not to give rise to infelicity in case of an inclusion relation. For instance, a singular NP with an indefinite article in (306b) is just as bad a continuation for the plural *two linguists*, as a singular proper name, cf. (306a). However, if the indefinite article is replaced by the numeral *one*, the discourse becomes more felicitous, and is interpreted in terms of inclusion, i.e. one of the two linguists who snore is a phonologist.

(305) Who snores?

- (306) a. # Two linguists (\setminus) . John (\setminus) .
 b. # Two linguists (\setminus) . A phonologist (\setminus) .
 c. ? Two linguists (\setminus) . One phonologist (\setminus) .

⁸Recall that our broad notion of coreference subsumes the relationships between NPs in predicative constructions such as *Mary is a linguist*, see fn. 3 on p. 146.

Once again, the Russian translations of (306) show the same contrast (an even sharper contrast in fact). In the Russian version of (306b), the singular term is expressed by a bare NP *fonolog* ('phonologist'), cf. (308b). Without an overt determiner an inclusion reading is impossible and the discourse is infelicitous. However, the insertion of the numeral *odin* ('one') makes the inclusion reading available, and the discourse becomes acceptable, cf. (308c).

(307) Kto xrapit?
 who snores

- (308) a. # Dva lingvista (↘) . Valera (↘) .
 two linguists Valera
 b. # Dva lingvista (↘) . Fonolog (↘) .
 two linguists phonologist
 c. Dva lingvista (↘) . Odin fonolog (↘) .
 two linguists one phonologist

A possible reason for this anomalous behaviour could be that numerals contain an implicit argument that anaphorically selects their quantification domain, whereas some other determiners and proper names do not have such an argument. In order to make this argument explicit, *two phonologists* in (302b) should be paraphrased as *two of them (are) phonologists*; similarly, in (306c). Obviously, NPs with an indefinite article and proper names do not allow for such a paraphrase, cf. **of them a linguist*, **of them John*.

Furthermore, the hypothesis that the relation between the numeral and the first NP is anaphoric is also supported by the fact that the order of the NPs cannot be reversed (cf. Hendriks and de Hoop, 2001). For instance in (310b) and (312b), if the numerals were able to take the NP *three linguists* as antecedent for their implicit domain argument then the inclusion reading should be possible; but since that NP has not been previously introduced, the anaphoric link cannot be established, and the interpretation appears to follow the general scheme: no inclusion reading is possible, the difference in group size is incompatible with strict coreference, and the discourse is infelicitous.

(309) Who snores?

- (310) a. ? Three linguists (↘) . Two phonologists (↘) .
 b. # Two phonologists (↘) . Three linguists (↘) .

(311) Kto xrapit?
 who snores

- (312) a. Tri lingvista (↘) . Dva fonologa (↘) .
 three linguists two phonologists
 b. # Dva fonologa (↘) . Tri lingvista (↘) .
 two phonologists three linguists

Finally, the quantifier *all*, which seems to have the same kind of implicit domain argument as the numerals, is interpreted differently, if the order of the NPs is changed. Thus, (314a) can be paraphrased as *20,000 people, all of them (are) linguists*, which leaves open the possibility that there are more linguists

than the 20,000 who subscribe to the LINGUIST List.⁹ By contrast, (314b) suggests that all linguists in the world subscribe to the LINGUIST List and there are 20,000 of them, i.e. the NPs corefer in the strict sense.¹⁰

(313) Who subscribes to the LINGUIST List?

- (314) a. 20,000 people (\searrow) . All linguists (\searrow) .
b. All linguists (\searrow) . 20,000 people (\searrow) .

The above facts constitute an exception both to the generalisation in (297) and to Potts' account of nominal appositives in terms of functional application, mentioned above. Although Potts (2005) does not discuss the same observations, for independent reasons he has to adopt a distinct analysis for appositives like *all linguists*, reconstructing them to something like *all of them are linguists* (see Potts, 2005, pp. 124–125). Thus it appears inevitable that such cases will receive a special treatment. I will not discuss the details of the analysis here, and will only concentrate on the general case captured by (297) in this study.

Summarising, in this section I have shown that there are both similarities and differences between nominal appositions and restatements. Although it might be tempting to analyse nominal restatement as a special case of nominal apposition, this is not always appropriate, especially if apposition is understood in the sense of Potts (2005). Many facts, such as (non-canonical) coreference between quantified expressions, or nominal restatements in Turkish and Japanese, are not intended to be captured by Potts' theory (which is the only formal semantic theory of nominal apposition to date). Thus these facts still need to be explained. The next section highlights a number of parallelisms between nominal restatement and sentential restatement which suggest a uniform treatment.

4.2.2 Nominal restatements vs. sentential restatements

This section is primarily concerned with the influence of intonation and the mode of connection (conjunction vs. asyndetic) on the inference of coreference relations that give rise to nominal restatements. As a systematic comparison will show, this effect is similar to the effect of *and* and intonation between two whole sentences, which was discussed at length in Chapter 3. To recapitulate briefly, the absence of conjunction between two sentences produces a restatement effect, i.e. the requirement of coreference between the main eventualities of those sentences, if both of them bear a completion intonation.¹¹ This effect disappears if a conjunction *and* is inserted and/or the sentences are uttered with a continuation intonation. Moreover, it was observed that if two sentences uttered with a completion intonation are connected asyndetically, but the restatement effect is incompatible with some part of “hard core” (e.g. lexically

⁹The figures correspond to the number of subscribers to the LINGUIST List by December 19th, 2004.

¹⁰Since *20,000* is a numeral and given our above observation that numerals in the second position allow for an inclusion reading, cf. (310a) and (312a), the example in (314b) should in principle also have such a reading, that is, the NP *20,000 people* should be able to be understood as presenting a proper part of all linguists. However, this reading is excluded since it would imply that some of the linguists are not people. But if *people* is replaced by *phonologists* the inclusion reading seems to be back again: *All linguists (\searrow) . 20,000 phonologists (\searrow)* .

¹¹Recall that we currently ignore the possibility of *Explanation* interpretation.

encoded) semantics of those sentences or associated world knowledge, then the listeners have difficulty processing the discourse, which leads to infelicity if no further context is provided. These generalisations are summarised in (315).

- (315) Generalisations about asyndetic connection:
- a. Asyndetic connection and completion intonation \Rightarrow coreference
 - b. Conjunction *and* and/or continuation intonation \Rightarrow no (necessary) coreference
 - c. Asyndetic connection and completion intonation, where the expressions' semantics is incompatible with coreference \Rightarrow infelicity

Moreover, the coreference effect associated with asyndetic connection and the $U_1 (\searrow) U_2 (\searrow)$ pattern arises independently of the relative order of U_1 and U_2 (although other factors may create a preference for one or the other ordering). Below I will consider the behaviour of asyndetically connected NPs with respect to these generalisations. The discussion will mainly concentrate on definites (proper names) and indefinites: proper names because they are simple to deal with and are well-suited for illustrative purposes, and indefinites because of all NPs, indefinite answers to constituent questions are the most similar to sentential answers to *What happened?*-type questions, thus they provide the best analogy and basis for a uniform treatment developed in the next chapters. Quantified restatements will not be considered in detail, although they are subject to the same regularities and are expected to be captured by the same analysis.

Coreference effect with falling statement intonation

To begin with, notice that when two NPs are uttered with a completion intonation as an answer to a *wh*-question, as in (316)–(317), there is absolutely no temptation to interpret them as referring to two distinct individuals. Even if the hearer has no previous knowledge about who Joyce and the author of *Ulysses* are, he will be able to infer from these answers that they are the same person.

(316) What/Who is this book about?

(317) Joyce (\searrow) . The author of *Ulysses* (\searrow) .

Furthermore, the acceptability and meaning of the answer does not change if the order of the NPs is reversed. (318) also implies that Joyce is the author of *Ulysses*.

(318) The author of *Ulysses* (\searrow) . Joyce (\searrow) .

In these examples, the restatement is formed by two definite NPs—proper names and uniquely referring definite descriptions. However, indefinite NPs appear to exhibit the coreference effect as well, if they are juxtaposed without an overt conjunction, and uttered with the same kind of completion intonation, as in (320) below.¹² Again, regardless of the order, both in (320a) and (320b) the NPs *a soldier* and *a man in uniform* are most naturally interpreted as

¹²Example adapted from Burton-Roberts (1975, p. 416).

referring to the same individual. This is a peculiar fact since according to the standard view, indefinites are subject to a novelty condition (Heim, 1982) which requires that the referent of an indefinite description not be familiar (i.e. previously introduced) in the discourse. However, in this anomalous behaviour nominal restatements are similar to sentential restatements like (321) where *a shirt* corefers with *a garment*.¹³

(319) Who is knocking on the door?

(320) a. A soldier (↘) . A man in uniform (↘) .
 b. A man in uniform (↘) . A soldier (↘) .

(321) Fred damaged a garment. He stained a shirt.

Russian seems to work in a completely parallel fashion here, with the only difference that the NPs are underspecified for definiteness.¹⁴ Hence, the NPs *soldat* ('soldier') and *mužčina v voennoj forme* ('man in uniform') may be interpreted as definite or indefinite, i.e. 'the soldier' or 'a soldier', etc. However, regardless of the interpretation and regardless of the order, the NPs corefer if uttered with a completion intonation and no conjunction in between.

(322) Kto stučit v dver' ?
 Who knocks in door

(323) a. Soldat (↘) . Mužčina v voennoj forme (↘) .
 soldier man in military uniform
 b. Mužčina v voennoj forme (↘) . Soldat (↘) .
 man in military uniform soldier

To summarise so far, two juxtaposed singular definite or indefinite NPs that each bear a falling intonation, and are uttered as an answer to a *wh*-question, are most naturally interpreted as coreferring both in English and Russian. Notably, the presence of this effect seems independent of the definiteness and the relative order of those NPs.

Definites and indefinites can also be combined in one restatement, e.g. (325). As before, a coreference effect is observed in (325a), however, (325b), where the definite NP is followed by the indefinite, sounds somewhat less felicitous. In other words, the symmetric relationship between the members of a restatement, observed in previous examples, seems to break down here.

(324) Who snores?

(325) a. A linguist (↘) . Mary (↘) .
 b. ? Mary (↘) . A linguist (↘) .

However, it seems that the apparent awkwardness of (325b) is due to pragmatic rather than syntactic or semantic reasons. Consider for instance (327) and (329) below. Both in English and in Russian, the ordering in the (b) versions where the NP *a child* follows the NP *a little girl* appears less felicitous than the ordering in the (a) versions. Here the NPs are equal in terms of definiteness, so the problem must be pragmatic. Indeed, it is difficult to think of a context

¹³See Danlos (1999) and Danlos and Gaiße (2004) for discussion.

¹⁴Russian has no obligatory definiteness marking, and accordingly, no equivalents for the English definite and indefinite articles. Bare NPs are used instead in most cases.

where the information that a child snores would still be of any interest after the hearer had learnt that a little girl snores. Given our lexical knowledge, the proposition that a little girl snores already entails that a child snores, which makes the latter completely redundant. By contrast, (327a) and (329a) are felicitous, since the utterance of the proposition that a little girl snores still adds some new information, even after we know that a child snores. As before, the NPs are interpreted as coreferring both in English and Russian.

(326) Who snores?

(327) a. A child (↘) . A little girl (↘) .
 b. ? A little girl (↘) . A child (↘) .

(328) Kto xrapit?
 who snores

(329) a. Rebenok (↘) . Devočka (↘) .
 child girl
 b. ? Devočka (↘) . Rebenok (↘) .
 girl child

Something similar could be going on in (325). Indeed, generally speaking, a proper name specifies a person in a much less ambiguous way than an indefinite description. In this sense it is more informative, which resembles the relation of *a little girl* to *a child*. However, unlike the case of *a little girl* and *a child*, this is not an entailment relation. Hence, it should be possible to think of a context in which the indefinite description is particularly informative, or *relevant*, even after the person has been specified by her proper name. For instance, imagine a situation where Ann has just claimed that linguists never snore, and seeking for support for her claim, she asks Bob who snores among the people he knows. If Bob utters (325b) in such a situation, the second NP *a linguist* implies counterevidence to Ann's claim and is not redundant at all, especially if Ann does not know (or has difficulty to access the information) that Mary is a linguist. Crucially, in this case the NPs still refer to the same individual with the given intonation, in the absence of an overt conjunction.

In other words, the apparent awkwardness of (325b) as compared to (325a) is due to the fact that the set of appropriate contexts for (325b) is much more restricted and marked than for (325a). This is reminiscent both of the problems encountered with restatements involving quantified NPs discussed in the previous section, and the asymmetries between the *Particularisation* and the *Generalisation* types of sentential restatements, cf. Chapter 2, pp. 22–24. In all these cases, however, differences in acceptability between the different orderings are due to factors that are orthogonal to those of interest here, namely those giving rise to a coreference effect. Thus a pragmatic theory of coreference in restatements may ignore these differences.

Now let's consider the plurals. The general picture is in fact not different from the singular case. With the given intonation there seems to be no way to interpret (331) as two linguists and *in addition* a student and a professor. The student must be one of those two linguists, and the professor must be the other. Similarly in (332), which is again a mixture of definites and indefinites, the most natural, if not the only possible interpretation is that the NPs *two linguists* and *John and Mary* refer to the same group of people. The set of possible contexts

for the version in (332b) is constrained in a similar way as for (325b) discussed above.

(330) Who snores?

(331) a. Two linguists (↘) . A student and a professor (↘) .
 b. A student and a professor (↘) . Two linguists (↘) .

(332) a. Two linguists (↘) . John and Mary (↘) .
 b. John and Mary (↘) . Two linguists (↘) .

Examples (334) and (335) present the Russian counterparts to (331) and (332), respectively. The judgements are again the same as for the English examples. Coreference is the only plausible reading available with the completion intonation pattern on both NPs and no conjunction connecting them.

(333) Kto xrapit?
 who snores

(334) a. Dva lingvista (↘) . Professor i student (↘) .
 two linguists professor and student
 b. Professor i student (↘) . Dva lingvista (↘) .
 professor and student two linguists

(335) a. Dva lingvista (↘) . Marina i Valera (↘) .
 two linguists Marina and Valera
 b. Marina i Valera (↘) . Dva lingvista (↘) .
 Marina and Valera two linguists

There is perhaps one point that should be mentioned specifically in connection with plural NPs, or to be more precise, NPs denoting groups of multiple persons or objects. Whereas for NPs that refer to singular individuals there are basically only two logical possibilities—they either corefer or not—group-denoting NPs allow for more options. Apart from being completely distinct or completely identical, groups can intersect, or be properly included in one another. It should be said right away that proper intersection is not among the possible readings of (331), (332), (334), or (335). An interpretation of, say, (332) under which John is one of the two linguists and Mary is a third person who snores seems highly unnatural. Proper inclusion, on the other hand, is only an issue for groups of different size, which is not the case in the examples considered so far. The possibility of proper inclusion between the NPs in asyndetic restatement has already been discussed in Section 4.2.1, see pp. 152–154. In the general case, inclusion is not among possible readings. Thus one can conclude that asyndetic connection of two NPs accompanied by a completion tune on both of them appears to be incompatible with the reading under which the referents of the NPs are distinct. This empirical generalisation holds both for singular NPs and for plurals.

Thus the emerging picture is as follows. If two NPs are connected asyndetically and are both uttered with falling statement intonation as an answer to a *who*- or a *what*-question, then the most natural, if not the only possible, interpretation is that these NPs corefer. This effect appears to be indifferent to the relative order of those NPs, i.e. whenever a sequence $NP_1(\downarrow) NP_2(\downarrow)$ exhibits the coreference effect, the reverse sequence $NP_2(\downarrow) NP_1(\downarrow)$ does, too. Third,

the coreference effect is observed between quantificational NPs of all kinds. The choice of a quantifier does not seem to play any role, even quantifiers that normally do not refer back to previously introduced individuals (e.g. indefinites), make an exception in this case. Finally, this pattern is strongly reminiscent of the bias for *Restatement* interpretation observed between two full sentences uttered as an answer to a question like *What happened?* or *What did John do?*, cf. Chapter 3, Table 3.2 on p. 105. The most obvious difference concerns the type of objects involved in coreference. Whereas in the case of NPs it is classical individuals or groups that corefer, in the case of sentences it is eventualities (or situations), as is the case in the examples (337) and (340). Note also that the relative order generally does not matter either, cf. (338) and (341).

(336) What happened?

(337) a. Alena broke her skis (↘) .

b. She lost her main means of transportation (↘) .

(338) a. Alena lost her main means of transportation (↘) .

b. She broke her skis (↘) .

(339) Čto slučilos'?

what happened

(340) a. Alena slomala lyži (↘) .

Alena broke skis

b. Ona lišilas' svoego osnovnogo transportnogo sredstva (↘) .

She lost her main transportation means

(341) a. Alena lišilas' svoego osnovnogo transportnogo sredstva (↘) .

Alena lost her main transportation means

b. Ona slomala lyži (↘) .

She broke skis

Such concatenations of sentences and the pragmatic effects associated with them are particularly similar to concatenations of two indefinite NPs (320), or even more so to concatenations of bare NPs in Russian, such as (323). Each sentence taken in isolation introduces an eventuality (just like an indefinite NP introduces an individual), without conveying any information whether this eventuality is new or identical to one already mentioned. In this sense they behave like Russian bare NPs. The intonational pattern and the absence of a conjunction in turn triggers the interpretation that the eventualities corefer.

In other words, NPs and sentences behave in a parallel fashion with respect to the first of the three generalisations in (315) concerning asyndetic connection.

No coreference effect with conjunction *and* or continuation intonation

The second generalisation that was discussed in connection with restatements involving full sentences is that the conjunction *and*, usually accompanied with a continuation intonation, “cancels” the event coreference effect that is otherwise observed with asyndetic connection, cf. (315b). The same holds for continuation intonation where the conjunction *and* is not (overtly) present, pp. 92–96 in

Chapter 3. Whereas in (337) above the sentences describe the same event, i.e. Alena lost her main transportation means *in breaking her skis*, in (343a) and (343b) this is a possible interpretation, but there is another, even stronger reading that the two happenings are distinct: Alena broke her skis and *apart from that* she lost her main means of transportation—perhaps her car was stolen. The same holds for the Russian discourses in (345) and (346).

(342) What happened?

- (343) a. Alena broke her skis (↗)
 and she lost her main means of transportation (↘) .
 b. Alena broke her skis (↗) ,
 she lost her main means of transportation (↗) , ...

(344) Čto slučilos' ?
 what happened

- (345) a. Alena slomala lyži (↗) ,
 Alena broke skis
 b. i lišilas' svoego osnovnogo transportnogo sredstva (↘) .
 and lost her main transportation means

- (346) a. Alena slomala lyži (↗) ,
 Alena broke skis
 b. ona lišilas' svoego osnovnogo transportnogo sredstva (↗) ...
 she lost her main transportation means

It is easy to see that this generalisation also holds for nominal restatements. If a conjunction *and* appears between two NPs (348a), or if asyndetically connected NPs are pronounced with continuation intonation (348b), the NPs are interpreted as referring to two distinct individuals. That is, both (348a) and (348b) convey the idea that a certain linguist snores and in addition Mary snores, Mary not being that linguist. The contrast to the asyndetic case with completion intonation (325a), repeated in (349), is even sharper than in conjoined sentences.

(347) Who snores?

- (348) a. A linguist (↗) and Mary (↘) .
 b. A linguist (↗) , Mary (↗) , ...

(349) A linguist (↘) . Mary (↘) .

Once again, Russian is not different from English in this respect. The conjunction *i* ('and') and/or rising intonation make the hearer interpret (351a) and (351b) as referring to groups of two distinct snorers, one of whom is a (or *the*) linguist and the other one is Valera.

(350) Kto xrapit?
 who snores

- (351) a. Linguist (↗) i Valera (↘)
 linguist and Valera
 b. Linguist (↗) , Valera (↗) , ...
 linguist Valera

There is no need to discuss various quantifier combinations in detail, since the impact of the conjunction *and* is always the same. It prevents coreference that would be inferred if the conjunction were not there and if the appropriate completion intonation were realised on each NP. The examples in (352) and (353) demonstrate this effect in English and Russian, respectively.

- (352) a. Joyce (↗) and the author of Ulysses (↘) .
 b. A soldier (↗) and a man in uniform (↘) .
 c. Two linguists (↗) , a student (↗) and a professor (↘) .
 d. Two linguists (↗) , John (↗) , and Mary (↘) .
- (353) a. Džojks i avtor Ulissa
 Joyce and author of Ulysses
 b. Soldat (↗) i mužčina v voennoj forme (↘) .
 soldier and man in military uniform
 c. Dva lingvista (↗) , professor (↗) , i student (↘) .
 two linguists professor and student
 d. Dva lingvista (↗) , Marina (↗) i Valera (↘) .
 two linguists Marina and Valera

Thus it is quite obvious that the contrast between juxtaposed and conjoined NPs resembles the contrast between juxtaposed and conjoined sentences. In both cases, the conjoined version correlates with non-coreference, i.e. non-coreference of individuals or groups denoted by the NPs or non-coreference of events described by the sentences. This shows that the second generalisation (315b) on our list can also be extended to NPs. Finally, let's consider the third generalisation (315c).

Infelicity with incompatible descriptions

The last one of the three generalisations about the role of asyndetic connection of sentences, cf. (315), concerns its infelicity or suboptimal character if the sentences present event descriptions that are incompatible when applied to one and the same event (or if the combination is very unlikely). This effect is in general not very strong, but it gets more evident in the context of an overt question. Recall the example (355) from Asher and Lascarides (2003, pp. 181–183, 199–204), cf. pp. 19–20, 66–67 in Chapter 2. Here it is rather unlikely that Kim watching TV and her studying refer to the same process, since it is rather unusual that someone would study *in* watching TV. In other words the lexical meaning of watch TV and study combined with our world knowledge is inconsistent with the coreference effect that takes place due the asyndetic connection.

(354) What did Kim do today?

(355) ? Kim watched TV (↘) . She studied (↘) .

As I argued in Chapter 3, pp. 101–103, the completion-completion pattern is

also incompatible with the proper inclusion of the second eventuality in the first one (*Elaboration*-proper). That is, asyndetic connection with the $U_1 (\searrow) U_2 (\searrow)$ pattern indeed requires strict identity.

(356) What did the council do?

(357) ?? The council built the bridge (\searrow) .

They got an architect to draw up the plans (\searrow) .

In nominal restatements, incompatible descriptions seem to lead to an even greater infelicity. For instance, the discourses in (359) do not make sense with the given intonation, whereas they are perfectly understandable if the conjunction *and* and/or rising intonation is used, cf. (360). As in the case of sentential restatements, this contrast can be explained by the conflict between the coreference reading induced by the completion intonation and asyndetic connection and the lexical information in the NPs that is incompatible with coreference. In (359a), the contradiction is induced by the knowledge that children and adults are disjoint classes of individuals. In (359b), it is the knowledge that brothers are male whereas *Mary* is normally a female name that leads to contradiction. Again, we have to do with two disjoint classes. Finally, in the same way as the $U_1 (\searrow) U_2 (\searrow)$ pattern plus asyndetic connection does not allow for an *Elaboration*-proper reading in pairs of sentences, it excludes the proper inclusion reading in pairs of NPs. Take (359c): in principle, John and Mary could be linguists, i.e. two of the three linguists mentioned, and hence form a *part of* the group introduced by the first NP. However, this is not a possible reading of (359c). As was argued in in Section 4.2.1, the combination of asyndetic connection and the $U_1 (\searrow) U_2 (\searrow)$ pattern generally requires strict coreference and not just inclusion, and the infelicity of (359c) is a consequence of this requirement. The example in (359d) provides further support for this claim, as it shows that the relative order of the NPs referring to the “bigger” and the “smaller” set does not play a role—the asyndetic pattern is infelicitous either way.

(358) Who snores?

(359) a. # A child (\searrow) . An adult (\searrow) .

b. # My brother (\searrow) . Mary (\searrow) .

c. # Three linguists (\searrow) . John and Mary (\searrow) .

d. # Two linguists (\searrow) . John, Mary and Bill (\searrow) .

(360) a. A child (\nearrow) and an adult (\searrow) .

b. My brother (\nearrow) and Mary (\searrow) .

c. Three linguists (\nearrow) , Mary (\nearrow) and John (\searrow) .

d. Two linguists (\nearrow) , John (\nearrow) , Mary (\nearrow) and Bill (\searrow) .

Again, Russian turns out to exhibit the same pattern as English. The examples in (362) and (363) are Russian near-equivalents of the English (359) and (360), respectively. As before, all the discourses in (362) are infelicitous, whereas their conjoined counterparts in (363) are fine. Notice that the inclusion reading of (362c) and (362d) is not available in Russian either. That is, in (362c) Marina and Valera cannot be understood as two of the three linguists mentioned and (362d) cannot be interpreted as Valera, Marina and Tamara, two of whom are linguists. This suggests that the asyndetic connection in Russian, as in English, requires strict coreference.

- (361) Kto xrapit?
 who snores
- (362) a. # Rebenok (↘) . Vzroslyj (↘) .
 child adult
 b. # Moj brat (↘) . Marina (↘) .
 my brother Marina
 c. # Tri lingvista (↘) . Valera i Marina (↘) .
 three linguists Valera and Marina
 d. # Dva lingvista (↘) . Valera, Marina i Tamara (↘) .
 two linguists Valera Marina and Tamara
- (363) a. Rebenok (↗) i vzroslyj (↘) .
 child and adult
 b. Moj brat (↗) i Marina (↘) .
 my brother and Marina
 c. Tri lingvista (↗) , Valera (↗) i Marina (↘) .
 three linguists Valera and Marina
 d. Dva lingvista (↗) , Valera (↗) , Marina (↗) i
 two linguists Valera Marina and
 Tamara (↘) .
 Tamara

Although there are some exceptions to this general strict coreference requirement which have to do with the presence of numerals and certain quantifiers, it was argued in Section 4.2.1, pp. 152–154, that such instances do not falsify the general case, as they probably demand a distinct treatment for independent reasons.

There is, however, another important group of counterexamples, which concerns both nominal and sentential restatements and which, at first glance, crosses all the generalisations made so far. This group includes lists with completion intonation, already mentioned in Chapter 3, pp. 139–140, cf. example (365), adapted from de Vries (2002, p. 214). Here the falling intonation is obviously not in conflict with the fact that the three NPs clearly denote completely distinct objects.

(364) What do we need?

(365) An office (↘) , computers (↘) , money (↘) .

However, lists with falling intonation such as (365) differ from the examples discussed earlier in at least two important respects. First, according to my intuition, they are prosodically distinct from restatements. The list items may be separated by no or very short pauses (indicated by commas instead of the usual periods in the example above). If (365) is pronounced like restatements with pauses comparable in length to pauses between two separate sentences, its acceptability decreases, cf. (366).

(366) ? An office (↘) . [pause] Computers (↘) . [pause] Money (↘) .

Second, the presence of a third and further items increases the chances that the sequence is interpreted as a list. This must be related to the tripartite

structure of lists pointed out by Jefferson (1990).¹⁵ Notice that if we remove the third item from (366), the discourse becomes as bad as other examples of incompatible descriptions discussed in this section.

(367) # An office (↘) . [pause] Computers (↘) .

Furthermore, it has been observed that lists with falling intonation create an additional pragmatic effect of “emphasis” or “ampleness,” see e.g. Kodzasov (1996a, pp. 97–98), or de Vries (2002, p. 214). All these observations suggest that such lists are special in many ways, which allows us to put them aside for now. I will briefly return to this issue in Chapter 6, Section 6.7.1.

Herewith, we finish the discussion of nominal restatements in connection with the third (and last) generalisation (315c), which says that if the semantics of asyndetically connected expressions is incompatible with them being coreferent, then the juxtaposition of these expressions each bearing a completion intonation is infelicitous. It was shown that asyndetically connected NPs answering a *wh*-question, just like asyndetically connected sentences, generally require strict coreference, and if some part of the semantics of these NPs is inconsistent with this requirement, the resulting discourse is indeed semantically ill-formed. That is, the third generalisation holds both for asyndetically connected sentences and NPs.

Thus, we have come to the end of this section’s agenda. Nominal restatements were compared to sentential restatements and shown to follow, in general, the same patterns with respect to asyndetic connection, conjunction and intonation, presented in (315) at the beginning of this section. To summarise, if two independent sentences or two NPs (bearing the same case) are simply juxtaposed without any overt lexical (*and*) or intonational (rise) indicators that they are syntactically connected, they *must* be interpreted as referring to the same eventuality or the same individual, or group of individuals. This effect is particularly evident in the context of an overt question that these sentences or NPs answer. The definiteness vs. indefiniteness of the NPs plays comparatively little role in their ability to corefer in restatements, although in other contexts this role is usually crucial. Similarly, the relative order of the NPs or sentences generally plays no role. Finally, any overt indication of connection between the sentences or the NPs, such as the coordinating conjunction *and* or continuation intonation, cancels the coreference requirement, and if this requirement was in conflict with some part of the semantics of the NPs or sentences, the insertion of a conjunction makes a felicitous discourse out of an infelicitous one.

On the other hand, a number of deviations from this general picture have been observed, too. One of them is the anomalous behaviour of certain quantifiers with respect to the coreference requirement. Whereas in general the asyndetic pattern with falling intonation leads to strict coreference, some quantifiers, such as the numerals or *all*, also make an inclusion reading possible. Another important exception is lists with falling intonation. Besides, there seems to be at least one rather general distinction in the behaviour of sentences and NPs in restatements. The semantic effects associated with NPs are usually “harder” than those associated with sentences. That is, for instance, where a sentential restatement is just slightly odd, a comparable nominal restatement is often

¹⁵See Chapter 3, pp. 94–95, for some related discussion.

badly infelicitous.

The formal analysis developed in Chapters 5 and 6 is primarily intended to handle the general case—the ways in which nominal and sentential restatements are similar, rather than different. The next section lays out some preliminaries for such an analysis.

4.3 Towards a formal analysis in terms of exhaustification

The general idea behind explaining restatement as a consequence of exhaustification was already outlined in the introduction to this chapter (Section 4.1). To recapitulate, the idea is that two unconnected statements (utterances bearing a completion intonation and not connected by a conjunction or the like) that answer a question are exhaustivized separately with respect to that question, whereas conjoined sentences form one statement, and hence the whole conjunction is exhaustivized. This should explain the coreference effect in the former case, and the lack of such effect in the latter.

The main purpose of this section is to spell out some preliminaries to a formal analysis of restatements in terms of exhaustification and put this investigation in a broader context of the current research on exhaustification in general. First of all, it should be emphasised once again that none of the existing theories of exhaustive interpretation was developed specifically with the purpose of handling restatements. Thus, I shall start with a brief survey of the existing theories in particular with respect to the linguistic and cognitive phenomena that constitute their original motivation (Section 4.3.1). Unfortunately, it will not be possible within just one dissertation to discuss all these theories in detail and test them all on restatements. Therefore, in Section 4.3.2, I will motivate my choice to discuss a particular selection of theories. Finally, in Section 4.3.3, I make explicit a number of general assumptions that have to be made about restatements if they are to be explained in terms of these theories.

4.3.1 Motivation for exhaustification

The need for a notion of exhaustive interpretation has long been realized by the linguists, logicians and researchers in artificial intelligence, and this realization has nothing to do with an intention to account for restatements. The motivation for this notion comes originally from three major sources. One of these sources was already mentioned in Section 4.1—it is the fact that *answers to questions* are by default interpreted as specifying the complete list of entities asked about by the questioner. That is, under normal circumstances one can infer from the answer *John* to the question *Who snores?* not only that John snores, which is the normal, semantic meaning of the answer, but also that no one else snores. The latter component of the meaning of (369) is due to exhaustive interpretation, and arguably is a pragmatic implicature rather than part of (369)'s semantics. This is supported by the observation that, like other conversational implicatures, the exhaustive interpretation of answers is *cancellable*: the “and that’s all” part of the answers’ meaning seems to evaporate if contradicting information is provided explicitly, cf. (370).

(368) Who snores?

(369) John.

(370) John. And Mary, too.

Exhaustification as implicature is usually reconstructed in terms of inference from the Gricean Maxim of Quantity: (i) make your contribution as informative as is required for the current purposes of the exchange; (ii) do not make your contribution more informative than is required. Roughly speaking, the question gives the speaker of (369) a clue of what kind of information is “required,” the speaker then tries to make his contribution as informative as possible with respect to this requirement. The hearer in turn relies on the speaker acting cooperatively in the above mentioned sense, and enriches the literal meaning of (369) with the information that this is the most informative answer that is true (roughly). But this implies that all more informative answers, e.g. *John and Mary*, *John*, *Sue and Bill*, are false. In consequence, John must be the only person that satisfies the query.

Although the idea behind this approach seems rather simple, its formal implementation is not trivial. Moreover, it is not just the reconstruction of Gricean reasoning that is tricky, but even simply capturing the result of this reasoning in a fairly general way from a purely descriptive point of view. This means defining a single exhaustification operator that would capture our intuitions about the exhaustive interpretation of NPs of different kinds: not only the simplest cases like *John*, but also answers like *John or Mary*, *perhaps John*, *not John*, as well as quantificational NPs such as *two students*, *every student*, etc. This task was addressed in particular by Groenendijk and Stokhof (1984), von Stechow and Zimmermann (1984), Zeevat (1994b), van Rooij and Schulz (2004b), among others, where van Rooij and Schulz (2004b) also attempt to reconstruct the reasoning with Gricean maxims behind it.

The second source of motivation for a notion of exhaustification comes from the need of capturing the lexical semantics of natural language expressions such as *only*, which, apparently, explicitly signal exhaustification. In this case, exhaustivity is part of the semantic meaning of the utterance rather than a conversational implicature, and hence cannot be cancelled, e.g. (371) is contradictory.

(371) # Only John snores. Mary snores, too.

A linguistic phenomenon that received particular attention among students of the semantics of *only* is its sensitivity to the position of prosodic focus. Specifically, the position of main stress (nuclear accent) in the utterance seems to determine the content of the exhaustive component of the meaning of utterances like (372a) and (372b). Both of these utterances share the part of meaning that says that John introduced Bill to Sue. However, in addition, (372a) conveys the idea that John did not introduce Bill to anybody else, whereas (372b) suggests that John did not introduce anybody else to Sue.

(372) a. John only introduced Bill to [SUE]_F.

b. John only introduced [BILL]_F to Sue.

The semantics of *only* and its focus sensitive character received formal treatment, for instance, in the works of Rooth (1985, 1992), von Stechow (1991), Bonomi and Casalegno (1993), Schwarzschild (1997). It should be noticed that

focus in these proposals plays roughly the same role in exhaustification as the question in the exhaustification of answers—it constrains what the “and that’s all” component of the meaning quantifies over. In the case of answers to questions, it quantifies over entities that satisfy the description in the question, i.e. “and that’s all who snore” in (369); in the case of *only*, it quantifies over individuals who satisfy the description that is obtained from the sentence by abstracting over the focused element, i.e. “and that’s all who John introduced Bill to” in (372a), vs. “and that’s all who John introduced to Sue” in (372b).

More generally, it is usually assumed that the specific contribution of exhaustification to the meaning of a sentence is the same regardless of whether it comes from the semantics of *only* or as an implicature associated with an answer to a question (apart from the fact that, of course, it is semantic in one case and pragmatic in the other). This led Zeevat (1994a) to suggest that exhaustivity itself cannot be part of the meaning of *only* since exhaustivity is present anyway, even in the absence of an explicit operator. On the other hand, it was observed that sometimes *only* and “bare exhaustification” produce different implications (cf. Umbach, 2004, pp. 165–166), which could mean that distinct notions of exhaustification are involved in each case. Moreover, different lexical exhaustification operators, e.g. *only* vs. *just*, arguably do not have the same meaning, and again it could be the case that different definitions of exhaustification are needed in order to capture these contrasts. However, these differences are not that well studied, so like most other linguists, I will continue to assume that the same notion of exhaustification is involved in *only* and in answers to questions, and that findings in one domain can be transferred to the other.

Finally, exhaustivity plays a central role in the process of reasoning, both in artificial agents (e.g. Shanahan, 1997) and in humans (Stenning and van Lambalgen, 2004). The idea is that a partial description of reality on which the reasoning is based—be that a sentence, a discourse, or the knowledge base of an intelligent system—is treated as if it were a complete description, i.e. by default what is not known is not the case. In the absence of this assumption the most basic reasoning mechanisms break down (a problem known in artificial intelligence as the “frame problem”). Thus exhaustivity is not just a feature of a couple of specific linguistic constructions, but a fundamental property of thinking. One of the prominent formal implementations of exhaustivity developed in artificial intelligence is the mechanism of *circumscription* (McCarthy, 1980, 1986), which has recently been adapted for linguistic problems by Hamm (2000) and van Rooij and Schulz (2004b). In other words, the linguistic phenomena that call for the notion of exhaustivity might all be reflexes of a more general cognitive process.

To sum up, the above survey should have made it obvious that exhaustification is a well-motivated and by now well-established theoretical construct. At the same time, none of the existing theories of exhaustification was developed with the goal of handling restatement. So if I succeed in showing that there is yet another phenomenon that exhaustification can explain, this would both give us an explanatory account of that phenomenon, and contribute to the success of exhaustification as a theoretical concept.

4.3.2 Theories of exhaustification

The next question to address is which theory provides the most suitable basis for an analysis of restatements. As it will not be possible to discuss all theories in detail, in this section I will present some considerations in favour of the first group of approaches introduced in the previous section, i.e. approaches that concentrate in particular on the exhaustive interpretation of answers to questions. One consideration is quite obvious: the hypothesis presented in Chapter 3 relates the restatement effect directly to question answering: one of the conditions for a coreference requirement between U_1 and U_2 is that the utterances answer the same question under discussion, whereas the completion intonation guarantees that they are intended as exhaustive answers.

On the other hand, there are considerations that at first glance speak against this choice. I noted in Section 4.1 that there is a remarkable gap between the notion of exhaustification that would be needed in order to account for restatement as a discourse phenomenon in its usual sense (sentential restatement) and the definitions of exhaustification provided by existing theories, which primarily deal with the exhaustive interpretation of NPs. Indeed, this is the case in theories that concentrate on answers to questions, since exclusively “constituent questions,” i.e. questions to NP constituents have been in their focus so far (e.g. Groenendijk and Stokhof, 1984). But theories that, for instance, pay primary attention to focus and the semantics of overt exhaustification operators like *only* (e.g. Rooth, 1985, 1992) in principle allow any syntactic category, including verbs, VPs and whole sentences, to serve as input to exhaustification, since almost any category can be prosodically focused, and this changes the meaning of a sentence with *only* accordingly. Why not take this approach as a starting point, instead of having to fill the above mentioned gap? After all, we saw in Section 4.2 that restatement is a cross-categorical notion.

In particular, the cross-categorical character of exhaustification in Rooth’s sense is intended to account for the following observations. Consider (372a) again, repeated in (373). According to the standard rules of focus projection (e.g. Selkirk, 1995), the main accent on *Sue* allows for a *broad focus* on the whole VP, cf. (374), which corresponds to the interpretation that introducing Bill to Sue was the only thing John did. Furthermore, in (375) the main stress is on the verb *introduced* and of course one would expect from a good theory of *only*’s semantics that it reflect the most natural interpretation of (375) that *introducing* was the only thing John did to Bill and Sue.

(373) John only introduced Bill to [SUE]_F.

(374) John only [introduced Bill to SUE]_F.

(375) John only [INTRODUCED]_F Bill to Sue.

Rooth tries to capture these facts by proposing that the contribution of *only* to the meaning of a sentence like *John only VP* consists in excluding all *focus alternatives* to VP, i.e. meanings of the same semantic type which differ from the given VP only in the instantiation of the focused element. Thus in (374) this set of alternatives would include all other possible activities of John. In (372a) the alternatives are introductions of Bill to people other than Sue, whereas in (372b) the introductions of people other than Bill to Sue. At first glance, this would suggest that an approach in the style of Rooth (also called *alternative*

semantics) is exactly what is needed to deal with the exhaustification of whole sentences. One just has to assume that such sentences have broadest focus possible, as in (376), and that a null exhaustification operator (here *only/exh*) semantically equivalent to Rooth's *only* applies to the meaning of the sentence and the set of alternative sentence meanings (all to be negated).¹⁶

(376) *only/exh* [Alena broke her SKIS.]_F

The reason for not taking this route is the well-known failure of alternative semantics to correctly account for the exhaustification of sentences with broad focus, and more generally, exhaustification of any expressions other than simple individuals (expressions of type *e*). The problem is that *only* quantifies over alternative expressions that in most cases cannot be assumed to be logically independent. For (376) this means that its exhaustive interpretation is equivalent to saying that *Alena broke her skis* is the only sentence that is true, which is not at all the same thing as saying that Alena breaking her skis is the only event that happened. The former entails for instance, that the sentences *Alena broke something*, or *Alena had been skiing*, or *Alena was breathing* are false, which is obviously an incorrect prediction. In the case of restatements like (265), repeated in (377) below, one would predict that the exhaustive interpretations of the sentences (377a) and (377b) exclude each other simply by virtue of not being the same expression, since according to Rooth's definition, (377a) is a valid alternative to (377b), and (377b) to (377a). In other words, such a notion of exhaustification is not helpful in explaining the phenomenon of restatement.

(377) a. [Alena broke her SKIS.]_F

b. [She lost her main TRANSPORTATION means.]_F

There have been lots of attempts in the literature to overcome these difficulties while maintaining the cross-categorical character of exhaustification. One way of approaching this problem is to impose constraints on the set of alternatives. Constraints that have been proposed are *relevance* (e.g. Roberts, 1996), *lumping* (Kratzer, 1989), and *logical independence* (Jasinskaja, 2002), but none of these proposals is completely satisfying for various reasons. For instance, a relevance constraint would require that only relevant propositions make up the alternative set of (377a). This constraint would exclude such propositions as *Alena was breathing* from the set of alternatives, since breathing is normally irrelevant (uninteresting) when breaking skis is at issue. However, the relevance constraint does not work for many other cases. As was noticed by Kadmon (2001, pp. 305–307), there is no intuitive reason why a proposition like *Alena broke something* is irrelevant while *Alena broke her skis* is under discussion. Moreover, I showed in Jasinskaja (2002) that at least if relevance is understood in terms of the ability of some information to resolve a question, some improper (logically non-independent) alternatives will *never* be ruled out by the relevance constraint. I also explored the possibility of explicitly requiring that the alternatives be logically independent from each other (a logical independence constraint). But this approach runs into difficulties with exhaustivity effects in some quantificational NPs. In particular, it fails to predict that *only some* implies *not all*.

¹⁶Recall the assumption made in Chapter 3, Section 3.1.1 that answers to questions like *What happened?* have broad focus.

Another way of approaching the problems of the original version of Rooth's theory is to modify the definition of the exhaustification operator itself (*only*). This strategy is taken by von Stechow (1991), Bonomi and Casalegno (1993), and Schwarzschild (1997). However, Schwarzschild (1997), who proposes a minimal modification to Rooth's original definition, only solves a small part of the problems,¹⁷ whereas von Stechow (1991) and Bonomi and Casalegno (1993) propose definitions that are not cross-categorial. Von Stechow only handles NPs, and Bonomi and Casalegno, although they declare maintaining the cross-categorial character of *only* in the spirit of Rooth as one of their goals, strictly speaking do not achieve this goal, as their ultimate definition is based on a listing of distinct cases for a number of distinct categories (cf. Bonomi and Casalegno, 1993, p. 34).

This is not to say that exhaustification cannot in principle be characterised in terms of alternatives in a category independent fashion. However, it seems so far that theoretical proposals that have concentrated primarily on the exhaustive interpretation of quantificational NPs (e.g. Groenendijk and Stokhof, 1984; von Stechow, 1991; Zeevat, 1994b; van Rooij and Schulz, 2004b), have achieved better results, at least from a purely descriptive point of view, thus taking these theories as basis for nominal restatements and extending them to cover sentence answers to "broad focus" questions as well as sentence restatements, looks easier than developing a working semantics for a cross-categorial exhaustification operator *à la* Rooth.

Thus I will base my analysis of restatement on a notion of exhaustivity developed for quantificational NPs used as answers to questions. It does not really matter which of the theories belonging to this group is taken, since all of them produce largely the same results for the most basic cases—proper names, singular and plural indefinite NPs—which will be enough to show the current proposal at work. However, it will be particularly instructive to discuss and test two of these theories: Groenendijk and Stokhof (1984) and van Rooij and Schulz (2004b). The choice of van Rooij and Schulz (2004b) is easy to motivate, since it is the most recent and the most comprehensive account of exhaustivity available. It provides answers to a lot of criticisms addressed at previous approaches (primarily Groenendijk and Stokhof, 1984) and can be regarded as the state-of-the-art version of this framework. Furthermore, van Rooij and Schulz' theory supercedes its predecessors in that it incorporates a powerful, formally precise, and independently motivated notion of *relevance*, which, as is well known, plays a central role in all phenomena involving exhaustive interpretation. Although relevance will not be crucial for analysing the basic cases of restatement, it will become important as soon as we try to embed the current proposal into a more general theory of implicit discourse relations. Yet before discussing van Rooij and Schulz (2004b), it will be useful to take a look at Groenendijk and Stokhof's original proposal, not only because it is more familiar and because van Rooij and Schulz (2004b) build up on it, but also because, as we will see, it could already correctly account for most cases of nominal restatements (once extended to the treatment of plurals). After Groenendijk and Stokhof (and of course, only as long as we are not concerned with relevance), the discussion of van Rooij and Schulz (2004b) will basically boil down to checking whether their results are as good as Groenendijk and Stokhof's. As the comparison will show, van Rooij and

¹⁷See Jasinskaja (2002) for discussion.

Schulz' proposal 'as is' calls for some minor improvements. Thus I will develop a theory of restatement on the basis of Groenendijk and Stokhof's (1984) and van Rooij and Schulz' (2004b) theories of exhaustification in Chapters 5 and 6, respectively.

4.3.3 Ingoing assumptions

Before proceeding to the formal implementation of the current proposal in the selected frameworks, a few final general remarks have to be made. In particular, I shall spell out some assumptions concerning restatement, exhaustification and the relationship between them. These assumptions were already present in the previous informal discussions (cf. Section 4.1), but now it is time to make them explicit.

Syntactic structure: The first assumption concerns the syntactic structure of asyndetically connected sentences and conjunctions. Asyndetic connection, as in (378a), will be assumed to give rise to two independent sentences not connected by any syntactic relation whatsoever. Each sentence forms an utterance. By contrast, explicitly conjoined clauses as in (378b) are coordinated constituents of a single sentence, so only the whole conjunction or the whole list forms an utterance.

- (378) a. Alena broke her skis (\searrow) .
 She lost her main means of transportation (\searrow) .
 b. Alena broke her skis (\nearrow)
 and she lost her main means of transportation (\searrow) .

Similarly, nominal restatements like (380a) will have to be analysed as sequences of elliptic sentences where the portion that repeats the predicate of the question (*snores* in the current case) has been deleted.¹⁸ A conjunction of NPs would then be reconstructed to a single sentence, cf. (380b).

- (379) Who snores?
 (380) a. A linguist \searrow (snores). Mary \searrow (snores).
 b. A linguist \nearrow and Mary \searrow (snore).

The role of the question: The second important assumption that has to be made has to do with the relation between the statements that form a restatement and the question(s) they answer. Exhaustification in Groenendijk and Stokhof's, as well as van Rooij and Schulz' proposals, on which the current analysis will be based, depends on two variables: the normal semantic meaning of the answer (*A*) and the "predicate of the question" (*P*), i.e. the predicate that we obtain from the question by abstracting over the *wh*-pronoun, cf. (381). Roughly, the exhaustive interpretation of *A* with respect to *P*—*exh(A, P)*—says that *A* is the only individual (or group of individuals) that *P*.

- (381) Who/What *P*?

¹⁸This is similar to Burton-Roberts' (1975, p. 406) original proposal towards the deep structure of nominal apposition. I use this idea to account for nominal restatement instead. (See Section 4.2.1 for a survey of similarities and differences between apposition and restatement.)

Obviously, if we want to derive a coreference effect from the exhaustive interpretation of two answers, we will have to assume that these answers are interpreted exhaustively with respect to *the same* question, as shown in (383). In other words, A_1 is the only thing that P and A_2 is the only thing that P , hence $A_1 = A_2$.

(382) Who/What P ?

(383) $exh(A_1, P) \wedge exh(A_2, P)$

If A_1 and A_2 are exhaustivized with respect to distinct question predicates P and Q — $exh(A_1, P) \wedge exh(A_2, Q)$ —we will generally not be able to infer that A_1 and A_2 are identical. If A_1 is the only thing that P , whereas A_2 is the only thing that Q , it does not follow that $A_1 = A_2$.

Global implicature: As mentioned in Section 4.1, the difference between asyndetically connected and conjoined answers should be reflected by the scope of exhaustification. If overt signals that A_1 and A_2 are connected are lacking, each of the answers is interpreted exhaustively, i.e. the exhaustification operator exh takes scope over one answer at a time, as in (384a). By contrast, if A_1 and A_2 are connected by an overt conjunction *and*, the whole conjunction forms one utterance, and hence it is the whole conjunction that is exhaustivized, cf. (384b). This is the crucial difference in the analysis of the two types of discourses which is supposed to explain the interpretive contrasts: a coreference effect in the first case, and no such effect in the second.

(384) a. Restatement: $exh(A_1, P) \wedge exh(A_2, P)$

b. Conjunction: $exh([A_1 \wedge A_2], P)$

This idea is based on the assumption that exhaustification applies *globally*, i.e. to whole utterances. There is however a theoretical option that conversational implicature (and exhaustification in particular) takes place locally and recursively at the level of the constituents of a sentence. If this is to be understood in such a way that in a conjunction the individual conjuncts are exhaustivized, it is not immediately clear whether and how the desired semantic contrasts between restatements and conjunctions could still be maintained.

In fact, the assumption that exhaustification, and more generally, conversational implicatures are active at the level of whole utterances rather than their parts is indeed quite standard in Gricean pragmatics. Moreover, this property has already been exploited in the analyses of other linguistic phenomena (cf. e.g. van Kuppevelt, 1996). However, this assumption has been questioned recently in a number of studies, e.g. Levinson (2000), Landman (2000), Chierchia (ms). These authors argue that computation of conversational implicatures must take place locally in order to account for some of the observed readings of sentences. I am not going to discuss the problematic data and the corresponding proposals in detail here, but two remarks should be made. First, the current approach to restatement may or may not be compatible with these proposals depending on the details of the analysis. In any case, it probably cannot be reconciled with the idea developed by Levinson (2000, pp. 245–259) that the Gricean inference process can be released, in principle, by *any* constituent of a sentence. Second, many of the problems raised by the proponents of the localist view have recently been given an alternative treatment by van Rooij and Schulz (2004a) in

a radically globalist framework. In other words, although this is a controversial matter and although the tenability of the current approach depends in part on the outcome of the localist-globalist debate, it is quite likely that the globalist view and hence the current proposal can be maintained.

4.4 Summary

In this chapter, I outlined an approach based on the notion of exhaustification to the analysis of the “restatement effect”—event coreference or individual coreference between asyndetically connected utterances bearing a completion intonation. Although the ultimate purpose of the current study is to account for implicit discourse relations between sentences and in particular, the canonical sentential restatement, a lot of attention was paid to the phenomenon of nominal restatement—coreference (in a broad sense) between asyndetically connected NPs which resembles nominal apposition. I argued that nominal restatement is distinct from apposition, and that the current theories of the latter, in particular Potts (2005), do not cover and are not intended to cover many facts pertaining to restatement. At the same time nominal and sentential restatements share a lot of properties, including the way they interact with intonation and asyndetic connection, which motivates a uniform analysis. Such an analysis will be developed in the next two chapters. Since the formal theories of exhaustification—Groenendijk and Stokhof (1984) and van Rooij and Schulz (2004b)—that were chosen as basis for the analysis are optimised for the exhaustive interpretation of NPs in answers to constituent questions, the observed parallelism between nominal and sentential restatement comes in handy as it allows us to first test these theories on nominal restatements, which is straightforward. The adjustment to the exhaustive interpretation of whole sentences and sentential restatement can then be carried out in the second step.

Chapter 5

Formal Analysis I: Groenendijk and Stokhof

In this chapter I will develop a pragmatic theory of restatement based on the notion of exhaustivity proposed by Groenendijk and Stokhof (1984, 1990, 1997). In the previous chapter I already presented some advantages of the exhaustification-based approach that concern its explanatory power. The next step is to check whether its predictions are also descriptively correct, in particular, if exhaustification is understood in Groenendijk and Stokhof's terms.

Thus the main purpose of this chapter is to give a descriptive account of the data discussed in Section 4.2.2 of the previous chapter. I will primarily focus on the requirement of strict coreference between two expressions that are connected *asyndetically* and are both uttered with a completion intonation in the context of an explicit question.¹ The expressions in question will be of two types: quantificational NPs and sentences that describe events. The coreference of classical individuals is at stake in the first case, and the coreference of events in the second. As discussed in Section 4.3.2, one apparent difficulty is the limitation of Groenendijk and Stokhof's original proposal to quantificational NPs, but this limitation is not essential, since VP and sentence denotations can also be lifted to quantifiers. This adjustment will have to be made in order to account for event coreference in sentential restatements.

This chapter is structured as follows. First I will present the relevant parts of Groenendijk and Stokhof's theory and briefly demonstrate how their notion of exhaustification works for some of the cases that it was originally intended for (Section 5.1). In Section 5.2, the theory will be applied to some simple cases of nominal restatements (in particular, restatements that involve singular NPs referring to atomic individuals). In Section 5.3, I will propose one possible way to extend Groenendijk and Stokhof's original proposal to handle the exhaustive interpretation of sentences as answers to *What happened?* questions, and apply it to sentential restatements. In the next step, Section 5.4 deals with pluralities—complex individuals (groups) and complex events—which present some difficulty

¹In the previous chapter we saw various exceptions from the strict coreference requirement, e.g. in concatenations of NPs where the quantifier in the second NP takes the set of individuals denoted by the first NP as its quantification domain (cf. Section 4.2.2). However, in this (as well as the next) chapter I will only concentrate on the general case and ignore such exceptions, which will be considered in Chapter 7.

for Groenendijk and Stokhof. I will discuss one possible way to overcome this problem and demonstrate the predictions for “plural” restatements. The role of the conjunction *and* and intonation in blocking the coreference effect is presented in Section 5.5. Finally, Section 5.6 takes stock of the achieved results and discusses some points of criticism of Groenendijk and Stokhof’s theory as a general theory of exhaustive interpretation. Even though most of these points have no direct bearing on the proposed theory of restatement, it is useful to consider them in view of a possible extension for the present approach to other discourse relations discussed in Chapter 2.

5.1 The basic setting

Groenendijk and Stokhof (1984) is more than a theory of exhaustification. As the title suggests, it is a study in the *semantics of questions* and the *pragmatics of answers*. Yet, according to the authors, exhaustivity plays a central role in both domains. In particular, Groenendijk and Stokhof take exhaustivity to be part of the semantics of interrogatives. This section, however, is primarily concerned with the second part—the pragmatics of answers; therefore, the aspects of exhaustivity that pertain specifically to interrogatives will not be discussed.

Here is a very brief introduction to the pragmatics of answers. In Groenendijk and Stokhof’s view, to know a *complete* answer to a question like *Who snores?* means to know for each individual in the domain whether they snore or not. Indeed, most of the time answers to questions are interpreted as complete. For instance, (386) suggests that John and Mary are the only individuals who snore, i.e. it can be inferred for all individuals other than John and Mary that they do not snore.

(385) Who snores?

(386) John and Mary.

However, the expressions that speakers use to answer questions (the “linguistic answers” as Groenendijk and Stokhof (1990) dub them) usually do not *explicitly* state that the provided list of individuals is complete. Nothing in the linguistic form of (386) or (387a) through (387c) indicates that other individuals do not snore (as opposed to examples in (388) which say so explicitly). In other words, the literal semantic meaning of answers in (386) and (387) only specifies that John and Mary, Mary or a linguist snore, but for the rest we do not know.

(387) a. Mary.

b. Mary snores.

c. A linguist.

(388) a. Only Mary.

b. Mary and John, but no one else.

This suggests that the literal meaning of answers has to be strengthened in order to reflect the information that they intuitively appear to convey. This “strengthening” is what is called exhaustification.

Groenendijk and Stokhof observe that the exhaustive interpretation of an answer does not only depend on its literal meaning, but also on the meaning of the question. For instance, (387a) interpreted as an answer to the question

(389a) suggests that Mary is the only person who snores, whereas in the context of the question in (389b), it suggests that Mary is the only linguist who snores. Hence, this property should also be reflected in the formal implementation of exhaustification.

- (389) a. Who snores?
 b. Which linguist snores?

Technically, the exhaustive interpretation of answers in Groenendijk and Stokhof's theory (1984; 1990) proceeds in two steps, cf. (390). First, an exhaustification operator (EXH) is applied to the semantic meaning of the NP, to construct its exhaustive meaning. More precisely, EXH takes as argument a generalised quantifier that reflects the literal meaning of the NP (e.g. *Mary*) and returns another generalised quantifier that corresponds to its exhaustive meaning (e.g. *Mary and no one else*). Second, the exhaustivized quantifier (type $\langle\langle e, t \rangle, t\rangle$) is applied to the so called *relational interpretation*,² a property (type $\langle e, t \rangle$) obtained from the interrogative by abstracting over the *wh*-element. This property is also often called the question abstract, or the *question predicate*—the predicate whose extension should be specified in the answer. For instance, for the question *Who snores?* it is simply the predicate *snores*, cf. (391).

- (390) The interpretation of a constituent answer α is $[\text{EXH}(\alpha')](\beta')$ where
 a. α' is the interpretation of the term α (a generalised quantifier);
 b. β' is the relational interpretation of a single constituent interrogative;
 c. EXH is the semantic operation of exhaustification.

(391) $\lambda x[\textit{snores}(x)]$

Finally, we come to the definition that will be central for all subsequent discussion—Groenendijk and Stokhof's definition of the exhaustification operator EXH, cf. (392). (The definition in (393) rephrases (392) in functional notation.)

(392) $\text{EXH}(Q) = \{P \mid P \in Q \wedge \neg \exists P' [P' \in Q \wedge P' \subset P]\}$

(393) $\text{EXH} = \lambda Q \lambda P [Q(P) \wedge \neg \exists P' [Q(P') \wedge P \neq P' \wedge \forall x [P'(x) \rightarrow P(x)]]]$

According to this definition, exhaustification works roughly as follows: it takes a quantifier Q , which is a set of sets of individuals or alternatively, a set of properties, and of all these sets/properties selects the minimal ones wrt. the proper subset relation \subset . For instance, if *Mary* is taken to be the set of properties of Mary, i.e. the set of sets that include Mary, the exhaustive interpretation of *Mary* will include only one singleton set, which contains just Mary, since this is the only one that has no further subsets within Q . Similarly, if the literal meaning of *a linguist* is a set of sets that intersect with the set of linguists (i.e. sets that contain at least one linguist), the exhaustive meaning is a set of singleton sets that contain exactly one linguist each.³ If the exhaustivized quan-

²The relational interpretation of a question is distinct from the actual semantics of an interrogative in Groenendijk and Stokhof (1990).

³Here, as well as in Groenendijk and Stokhof (1990, cf. p. 35), the meaning of an indefinite is simply taken to be that of an existential quantifier, or the montagovian *some*, cf. (395a). This old-fashioned approach to the semantics of determiners will be used throughout this chapter for the sake of simplicity, but this assumption is not essential. The nowadays more

tifier ($\text{EXH}(\mathcal{Q})$) is next combined with the question predicate (P), the resulting proposition is $P \in \text{EXH}(\mathcal{Q})$, which makes the extension of P minimal.

For example, (394) and (395) show the steps (cf. (390)) of computing the exhaustive interpretation of the answers *Mary* and *a linguist* with respect to the question *Who snores?* (in functional notation). The expression in (a) is the literal semantic meaning of the NP; (b) is the result of exhaustification of that NP using (393);⁴ whereas (c) is what we get after substituting the question predicate *snores* for P .

- (394) a. $\| \text{Mary} \| = \lambda P[P(m)]$
 b. $\text{EXH}(\| \text{Mary} \|) = \lambda P \forall x [P(x) \leftrightarrow x = m]$
 c. $[\text{EXH}(\| \text{Mary} \|)](\text{snores}) = \forall x [\text{snores}(x) \leftrightarrow x = m]$
- (395) a. $\| \text{a linguist} \| = \lambda P \exists x [\text{linguist}(x) \wedge P(x)]$
 b. $\text{EXH}(\| \text{a linguist} \|) = \lambda P \exists x [\text{linguist}(x) \wedge \forall y [P(y) \leftrightarrow x = y]]$
 c. $[\text{EXH}(\| \text{a linguist} \|)](\text{snores}) = \exists x [\text{linguist}(x) \wedge \forall y [\text{snores}(y) \leftrightarrow x = y]]$

It is quite obvious that both (394c) and (395c) reflect our intuitions about the exhaustive reading of the answers rather well: (394c) says that Mary is the only individual who snores, and (395c) states that there is a linguist and that linguist is, again, the only snorer. In other words, Groenendijk and Stokhof's definition of exhaustification provides plausible results in such simple cases. Of course, this illustration shows only the smallest part of what Groenendijk and Stokhof's theory is capable of. However, this will be enough for the time being, since now we can already demonstrate how this notion of exhaustification works in restatements that are equally simple.

5.2 Some simple nominal restatements

Recall the examples (325a), (327a) and (359a) from Section 4.2.2, repeated in (397) below. In (397a) and (397b) we observe the coreference reading, that is, we can infer that Mary is that linguist who snores, and the NPs *a child* and *a girl* refer to the same single snorer. By contrast, (397c) is infelicitous and, as I argued in Section 4.2.2, this infelicity is due to the fact that the absence of a conjunction and the completion intonation on both NPs *requires* that the NPs corefer, but since one and the same person normally cannot be a child and an adult at the same time, a contradiction arises.⁵ In this section, it will be shown that this coreference requirement is correctly predicted by Groenendijk and Stokhof's notion of exhaustification.

(396) Who snores?

standard dynamic approach, which makes a distinction between strong and weak determiners etc., can also be successfully combined with the notion of exhaustification *à la* Groenendijk and Stokhof, as it is done, for instance, in van Rooij and Schulz (2004b, pp. 16–20). The predictions that are most essential for our purposes remain the same.

⁴The equivalence of $\text{EXH}(\lambda P[P(m)])$ and $\lambda P \forall x [P(x) \leftrightarrow x = m]$, as well as $\text{EXH}(\lambda P \exists x [\text{linguist}(x) \wedge P(x)])$ and $\lambda P \exists x [\text{linguist}(x) \wedge \forall y [P(y) \leftrightarrow x = y]]$ are theorems that follow from Groenendijk and Stokhof's definition of exhaustification, cf. Appendix A.3.2.

⁵Henceforth, the arrow notation for completion and continuation intonation will be suppressed, where unambiguous. A period is generally used in place of completion intonation, and a comma in place of continuation.

- (397) a. A linguist. Mary.
 b. A child. A girl.
 c. # A child. An adult.

As I proposed in Section 4.3.3, whenever two NPs are not overtly connected—by a conjunction or intonationally—they are processed by the hearer as two separate utterances, each being interpreted exhaustively. Hence the exhaustification operator should take narrow scope over each NP, cf. (384a) in Chapter 4. Furthermore, we assumed that these utterances are exhaustivized with respect to the same question, e.g. *Who snores?*, which they answer. Given Groenendijk and Stokhof’s construction for the exhaustive meanings in (390), the interpretation of the discourses in (397) should be computed from (398).

- (398) a. $[\text{EXH}(\|a \text{ linguist}\|)](\textit{snore}) \wedge [\text{EXH}(\|Mary\|)](\textit{snore})$
 b. $[\text{EXH}(\|a \text{ child}\|)](\textit{snore}) \wedge [\text{EXH}(\|a \text{ girl}\|)](\textit{snore})$
 c. $[\text{EXH}(\|a \text{ child}\|)](\textit{snore}) \wedge [\text{EXH}(\|an \text{ adult}\|)](\textit{snore})$

For instance, let’s first consider the interpretation of (397a). By Groenendijk and Stokhof’s definition of EXH, the exhaustifications of *a linguist* and *Mary* are equivalent to (399a) and (399b), cf. (395c) and (394c) in the previous section. If these propositions are substituted to (398a), we get (400), which in turn is equivalent to (401). The formal derivation is given in Appendix A.3.3. Intuitively, the inference goes as outlined in Section 4.1. The first part of the answer says that there is a linguist who snores and this is the only person who snores. The second part of the answer says that Mary snores and she is the only person who snores. Hence, Mary must be that linguist, because otherwise we would have more than one person snoring.

- (399) a. $\exists x[\textit{linguist}(x) \wedge \forall y[\textit{snore}(y) \leftrightarrow x = y]]$
 b. $\forall x[\textit{snore}(x) \leftrightarrow x = m]$

$$(400) \exists x[\textit{linguist}(x) \wedge \forall y[\textit{snore}(y) \leftrightarrow x = y]] \wedge \forall z[\textit{snore}(z) \leftrightarrow z = m]$$

$$(401) \textit{linguist}(m) \wedge \forall y[\textit{snore}(y) \leftrightarrow y = m]$$

Thus the last statement entails that there is exactly one individual who snores, which is Mary ($\forall y[\textit{snore}(y) \leftrightarrow y = m]$) and Mary is a linguist ($\textit{linguist}(m)$). But this is the same as saying that the NPs *a linguist* and *Mary* corefer. That is, we have shown that Groenendijk and Stokhof’s exhaustification indeed leads to coreference of an indefinite description and a proper name, which correctly reflects our intuitions about the interpretation of discourses such as (397a).

In a similar way, a coreference requirement can be derived for two indefinite descriptions, as in (397b). Assuming that the NPs *a child* and *a girl* receive literal and exhaustive interpretations along the same principles as the NP *a linguist*, (398b) turns into (402) after substitution. Although the existential quantifiers associated with the indefinites take distinct scopes in (402), coreference follows from the conjuncts $\forall x'[\textit{snore}(x') \leftrightarrow x = x']$ and $\forall y'[\textit{snore}(y') \leftrightarrow y = y']$, contributed by the exhaustive interpretation i.e. (402) is equivalent to (403), see Appendix A.3.4 for a proof. I.e. there is exactly one child who snores, in particular, a girl. The inference is similar to that in the previous case. The NPs *a child* and *a girl* must refer to the same individual, since they both refer to a snoring individual, and there is only one.

$$(402) \exists x[\textit{child}(x) \wedge \forall x'[\textit{snore}(x') \leftrightarrow x = x']] \wedge \\ \exists y[\textit{girl}(y) \wedge \forall y'[\textit{snore}(y') \leftrightarrow y = y']]$$

$$(403) \exists x[\textit{child}(x) \wedge \textit{girl}(x) \wedge \forall x'[\textit{snore}(x') \leftrightarrow x = x']]$$

However, the above discourses receive sensible interpretations since the NPs are “compatible”, i.e. applicable to the same individual, as *child* and *girl*, or *Mary* and *a linguist* certainly are. But if the same mechanism is applied to a discourse like (397c), Groenendijk and Stokhof’s exhaustification will again predict that the NPs *a child* and *an adult* must corefer, just like in the previous example, that is, (398c) proves equivalent to (404), which is inconsistent with the meaning postulates (or world knowledge), since children are not adults, cf. (405). Arguably this is the reason for the infelicity of (397c).

$$(404) \exists x[\textit{child}(x) \wedge \textit{adult}(x) \wedge \forall x'[\textit{snore}(x') \leftrightarrow x = x']]$$

$$(405) \forall x[\textit{child}(x) \rightarrow \neg \textit{adult}(x)]$$

A couple more conclusions can be drawn on the basis of this brief illustration. First of all, since Groenendijk and Stokhof’s exhaustification operator is intended to reflect the result of Gricean reasoning from the Maxim of Quantity (cf. Section 4.3.1), and Gricean pragmatics is in turn supposed to capture the regularities of human rational and cooperative behaviour, one should naturally expect that exhaustification works in more or less the same way in all languages, including Russian.⁶ If in addition we assume that Russian bare NPs receive the same semantic interpretations as the English indefinites, then the results obtained for the English examples in (397) carry over to the corresponding Russian examples (329) and (362a), discussed in Section 4.2.2.

Second, it is quite obvious that if the order of NPs in (397) is reversed, we arrive at exactly the same interpretations—coreference is predicted either way. This is simply due to the fact that we used classical conjunction (\wedge) to combine the exhaustive interpretations of individual answers, cf. (398), and conjunction is symmetrical. As I argued in Section 4.2.2, this is, in general, a correct prediction.

To summarise, this section has shown that the proposed theory of restatement based on Groenendijk and Stokhof’s definition of exhaustification makes plausible predictions for a considerable number of examples that were discussed in Section 4.2.2. In particular, it accounts for the coreference effect in asyndetically connected NPs, and the infelicity of asyndetic connection between NPs that provide incompatible descriptions of an individual. Only very simple cases of restatements that involve singular indefinites or an indefinite and a proper name were discussed here. Recall that the ultimate goal of the current investigation is sentential restatements, and event coreference effects that arise in them. Therefore we shall turn to that topic in the next section with the tools we have so far.

⁶Of course, cultural pragmatics can, in principle, interfere with basic human rationality, which can lead to exceptions to this generalisation.

5.3 Application to sentential restatements

In the previous section it was shown that Groenendijk and Stokhof’s theory of exhaustification correctly predicts a restatement effect when two NPs serve as answer to the same question. In the case of NPs, i.e. quantifiers over individuals, the restatement effect consists in the coreference of the individuals the NPs introduce. In this section, this approach is extended to cover the event coreference effect in sentence restatements, i.e. asyndetic sequences of sentences that answer “broad focus” questions such as *What happened?* or *What did John do?* I will refer to such questions as S and VP questions. An S question is a question “to a whole sentence”, such as *What happened?*, and induce the broadest focus in the sentential answer, i.e. the whole sentence is in focus, as in (407). In a sentential answer to a VP question, the focus is on the VP, cf. (409).⁷

(406) What happened?

(407) a. [Alena broke her skis.]_F

b. [She lost her main transportation means.]_F

(408) What did Anatolij do?

(409) a. Anatolij [shaved off his beard.]_F

b. He [fulfilled Alena’s dearest wish.]_F

Groenendijk and Stokhof have remarked that although their definition of exhaustification is formulated primarily to handle NPs as answers to questions about individuals, the approach is not limited to the treatment of expressions of type $\langle\langle e, t \rangle t\rangle$, since an expression of any type, including the denotations of VPs and whole sentences, can be lifted to a quantifier type. However, to my knowledge, an application to VP and S questions, i.e. question about events, has not been worked out in detail.⁸ In this section, I develop a preliminary proposal towards such an application. This involves figuring out what contribution S and VP questions make to the exhaustive interpretation of their answers, as well as defining a type-shifting operator that applies to sentential answers to turn them into quantifiers. In Section 5.3.1, I will argue that treating S and VP questions as analogous to NP questions is not just an easy technical solution but can also be motivated by a number of linguistic facts. In Section 5.3.2, I will present a set of assumptions which are necessary to implement this idea. Finally, Section 5.3.3 will illustrate the main predictions of this approach wrt. sentential restatements.

5.3.1 Some observations

I would like to start with a rather naive observation. If we look at the linguistic form of S and VP questions (410), we see that they look very similar to NP

⁷See Chapter 3, pp. 80–84, on the relationship between accent, focus, and the notion of question-answer congruence.

⁸An approach to exhaustive interpretation of representations of events has been developed in AI based on McCarthy’s (1980; 1986) notion of predicate circumscription, cf. Shanahan (1995, 1997), and Hamm (2000) applied it to a number of linguistic problems that involve events, though not to question answering. Circumscription was also applied to question answering by van Rooij and Schulz (2004b), cf. Chapter 6, but not to questions about events. This gap should be filled in this section.

questions: the question word *what* is a *pronoun*, and the *wh*-phrase is syntactically an NP. As far as the syntactic structure is concerned, the interrogative sentence *What happened?* is not much different from sentences like *What fell?* or *Who snores?*; whereas questions such as *What did John do?* are like *What did John buy?* Both English and Russian, cf. (411), as well as most other languages (about 90% according to Idiatov and van der Auwera, 2004), employ this strategy in phrasing VP and S questions: a combination of a nominal interrogative word (*what*) and a normal, non-interrogative verb with generic meaning, e.g. *happen*, *do*, *be*. It would be natural to hypothesise that in such languages S and VP questions should also receive in principle the same semantics as NP questions.⁹

- (410) a. What happened?
 b. What is going on?
 c. What did John do?
 d. What happened to Mary?
 e. What is Bill going to do tomorrow?

- (411) a. Čto slučilos' ?
 What happened
 b. Čto proisxodit?
 What is going on
 c. Čto sdelal Valera?
 What did Valera
 d. Čto slučilos' s Marinoj?
 What happened with Marina
 e. Čto Valera zavtra sobiraetsja delat' ?
 What Valera tomorrow is going to do

There are also other similarities between questions like *What happened?* and questions like *What fell?* that suggest a uniform treatment. For instance, S and VP questions can also be answered by NPs, cf. (412)–(413) and (414)–(415).¹⁰

- (412) What happened?

- (413) a. An accident.
 b. The worst.
 c. What I had expected.

- (414) What did John do?

⁹Languages with interrogative *pro-verbs* are much more rare, yet they exist and make out approximately 10%, according to Idiatov and van der Auwera's (2004) scrutiny of about 350 languages. For instance, Kayardild (a Tangkic language of Australia) uses interrogative verbs in VP questions, as the following example adapted from Idiatov and van der Auwera (2004) illustrates:

- (i) nyingka ngaaka-wath?
 you what-INCHOATIVE
What are you doing? ("You are whatting?")

It is possible that broad focus questions in languages like Kayardild should receive a different semantics than the one proposed in this section. Hence the current discussion does not apply to languages of this sort.

¹⁰See also Chapter 3, pp. 82–83 for related observations.

- (415) a. Nothing.
 b. A really stupid thing.
 c. Something he will regret.

Finally, NPs and sentences can be combined in restatements. A question such as *What happened?* can be answered by a sequence of an NP and an S with a similar coreference effect to the one observed in discourses where two NPs or two sentences answer the same question. For example, (417) suggests that the accident that happened *consisted in* Mary falling from the ladder, i.e. (417a) and (417b) refer to the same happening. The discourse in (419) implies that John will regret marrying Sue.

(416) What happened?

- (417) a. An accident.
 b. Mary fell from the ladder.

(418) What did John do?

- (419) a. Something he will regret.
 b. He married Sue.

In light of these considerations, I will simply treat the relationship between questions like *What happened?* and exhaustive answers to such questions—whether sentential or nominal—in the same way as the relationship between constituent questions and their answers is treated in Groenendijk and Stokhof’s theory.

5.3.2 A proposal

The exhaustive interpretation of answers in Groenendijk and Stokhof’s theory has three ingredients, cf. (390) in Section 5.1: (a) a generalised quantifier representing the normal, non-exhaustive interpretation of the answer; (b) the question predicate; and (c) an exhaustification operator that takes a non-exhaustive answer and turns it into an exhaustive one. None of that changes for answers to *What happened?* questions. The exhaustification operator EXH (393) is adopted ‘as is’. The question predicate is what the linguistic form of the question suggests it to be: in (420) it is the predicate *happen*, or the set of “things” that happened; in (421), it is the set of “things” done by John.¹¹ The only difference is that these “things” are events rather than individuals, which is due to the selectional restrictions of the verbs *happen* or *do*.

- (420) a. What happened?
 b. $\lambda e[happen(e)]$

- (421) a. What did John do?
 b. $\lambda e[do(j, e)]$

The only point that perhaps needs clarification is how sentential answers such as (417b) and (419b), can be represented as quantifiers, so that Groenendijk and Stokhof’s EXH can be applied to them. The first thing that comes to mind is the following. It is not uncommon in event semantics to assume that sentences

¹¹Tense and aspect information is ignored in the examples.

denote properties of events rather than propositions, i.e. objects of type $\langle E, t \rangle$, where E is a type for events.¹² For instance, the meaning of a sentence like *John sneezed* (422) is represented as shown in (423a). This makes the event variable accessible for further modification by temporal or spatial adverbials, etc. After the whole sentence has been processed, the property denotation undergoes *existential closure*—an operation that turns an open proposition like (423a) into an existentially quantified complete proposition, cf. (423b). For answers to questions, one could similarly define a type-shifting operation that converts an open proposition into a quantifier like (423c). The required operation is defined in (424).

(422) John sneezed.

(423) a. $\lambda e[sneeze(e, j)]$
 b. $\exists e[sneeze(e, j)]$
 c. $\lambda P \exists e[sneeze(e, j) \wedge P(e)]$

(424) Existential quantifier shift:
 $\text{EQS} = \lambda Q \lambda P \exists e[Q(e) \wedge P(e)]$

Note that (424) is nothing else but the indefinite determiner denotation assumed by Groenendijk and Stokhof (1990), or the montagovian denotation of *some* (cf. fn. 3 on p. 177). In other words, the sentence *John sneezed* is translated into something like “*a sneeze of John*” at the semantic level.¹³ And indeed, the sentence and the nominalization seem to lead to approximately the same entailments and exhaustivity effects when they answer the question *What happened?*, cf. (425)–(426).¹⁴ One could object though that even in answers to questions, a sentence and its nominalization do not always mean the same thing. Compare for instance (425)–(426) to (427)–(428). Whereas (428b) could perhaps be understood as ‘John did not sneeze’, (428a) does not make much sense at all.

(425) What happened?

(426) a. John sneezed.
 b. “A sneeze of John.”

(427) What did not happen?

(428) a. ?? John sneezed.
 b. “A sneeze of John.”

First of all, it should be noted in this connection that the fact that we are forced to “nominalise” sentence denotations in order to be able to exhaustivize them is largely technicality dictated by the specific layout of Groenendijk and Stokhof’s theory. In Section 6 we will see that this step is not needed, for instance, in van Rooij and Schulz’ (2004b) setting, where the proposition is taken

¹²In the current setting, it is not essential that classical individuals and events be assigned distinct semantic types. Arguably, a two-sorted and a one-sorted logic are equally expressive and mutually interchangeable, cf. e.g. Hamm (2000, pp. 71–72).

¹³A semantics in which nominalisations (perfect nominals) are represented as generalised quantifiers is developed, for instance, in Hamm (2000, pp. 138–148).

¹⁴Of course, something is very wrong with the nominalization answer pragmatically. At least in English, people do not usually speak like this. Still, if the nominalization answer is to be understood at all, it is to be understood roughly in the same way as the sentential answer.

to be the basic semantic type for answers. Thus, (part of) the problem will disappear by itself.¹⁵ Still, as long as we are working with Groenendijk and Stokhof (1984), one could assume that *happen*(*e*) is part of the meaning of the sentence, but not of the nominalization. Hence, *John sneezed* should be translated as (429) rather than (423a), so its EQS-type-shifted version also contains the *happen* predicate, cf. (430). In other words, a more appropriate paraphrase for *John sneezed* after type shifting is “*a sneeze of John that happened*”, rather than simply “*a sneeze of John*”. This change should be sufficient to account for the contrasts between (425)–(426) and (427)–(428).

$$(429) \lambda e[sneeze(e, j) \wedge happen(e)]$$

$$(430) \lambda P \exists e[sneeze(e, j) \wedge happen(e) \wedge P(e)]$$

Thus the current proposal reduces the problem of exhaustivizing sentential answers to *What happened?* questions to a problem previously solved—the exhaustification of indefinite NPs such as *a linguist*, cf. (395). The step-by-step computation of the exhaustive meaning of *John sneezed* is given in (431): (431a) and (431b) show once again the normal and the type shifted semantic interpretation of the sentence; (431c) is the exhaustive interpretation of the quantifier;¹⁶ whereas (431d) is the exhaustive interpretation with the question predicate *happen* plugged in. The latter is in turn equivalent to (432), whose parallelism to the exhaustive interpretation of *a linguist (snores)*, repeated in (433), is quite obvious.

$$(431) \text{ a. } \|\text{John sneezed}\| = \lambda e[sneeze(e, j) \wedge happen(e)]$$

$$\text{ b. } \text{EQS}(\|\text{John sneezed}\|) = \lambda P \exists e[sneeze(e, j) \wedge happen(e) \wedge P(e)]$$

$$\text{ c. } \text{EXH}(\text{EQS}(\|\text{John sneezed}\|)) =$$

$$\lambda P \exists e[sneeze(e, j) \wedge happen(e) \wedge \forall e'[P(e') \leftrightarrow e = e']]$$

$$\text{ d. } [\text{EXH}(\text{EQS}(\|\text{John sneezed}\|))](happen) =$$

$$\exists e[sneeze(e, j) \wedge happen(e) \wedge \forall e'[happen(e') \leftrightarrow e = e']]$$

$$(432) \exists e[sneeze(e, j) \wedge \forall e'[happen(e') \leftrightarrow e = e']]$$

$$(433) \exists x[linguist(x) \wedge \forall y[snore(y) \leftrightarrow x = y]]$$

It is also clear that (432) reflects our intuitions about the exhaustive interpretation of sentences that describe events. It says that there was an event in which John sneezed, and that was the only event, or in other words, John sneezed and nothing else happened.

As far as answers to the question *What did John do?* are concerned, as well as answers to other broad focus questions like those listed in (410), the analysis proceeds along the same lines, except that the question predicates are more informative in those cases. For instance, the predicate *do* can be translated roughly as in (434), which makes a sentence like *John did X* equivalent to *X happened and John was the agent of X*.

$$(434) do = \lambda x \lambda e[happen(e) \wedge agent(x, e)]$$

¹⁵Of course, if answers must be propositions then we have to solve the other problem: turning (denotations of) constituent answers (NPs) into (denotations of) full sentences. However, this is a much more standard way to proceed that ultimately reduces to ellipsis reconstruction, which is a general problem that we will not worry about in this study.

¹⁶The derivation is the same as for *a linguist*, cf. fn. 4 on p. 177.

The proposed analysis thus provides a simple illustration for the fact that Groenendijk and Stokhof’s (1984; 1990) approach to exhaustification is in principle not limited to NPs, contrary to the criticism of e.g. Bonomi and Casalegno (1993). Broad focus questions and sentential answers to such questions can be treated by analogy, exploiting the common assumption of event semantics that events are nothing more than a special kind of individuals. As a theory of exhaustification of event descriptions, the current proposal is in fact based on a similar idea as, for instance, those of Shanahan (1997) and Hamm (2000). In both cases, a notion of exhaustive interpretation is combined with a formal language that represents events as a special sort of objects, with the same (interim) purpose: a representation of an event (or a number of events) must be associated with the non-monotonic inference that the events explicitly represented are also the only events that actually took place. Moreover, the exhaustive interpretation mechanism used by Shanahan and Hamm is McCarty’s (1980) notion of circumscription, of which Groenendijk and Stokhof’s exhaustification is arguably a special case, cf. van Rooij and Schulz (2004b). The most important differences from the theories of Shanahan and Hamm are twofold. First, our proposal is cast in terms of a version of event semantics that is more common in linguistics than Shanahan’s event calculus (also used by Hamm). Second, the proposal relates the exhaustive interpretation of event descriptions to questions about events. This goal was not pursued in the previous works, but it is important for an analysis of restatement and its relation to question answering. What is left now is to apply the approach developed in this section to restatement and study the above-mentioned predictions.

5.3.3 Predictions with respect to restatements

An immediate consequence of the approach proposed above is that all the predictions of Groenendijk and Stokhof’s theory with respect to coreference of individuals in nominal restatements, discussed in Section 5.2, are inherited by restatements involving sentential event descriptions.¹⁷ For instance, consider the discourse in (407) once again, repeated in (436). If we apply the existential quantifier shift (424) to the literal meanings of (436a) and (436b), and exhaustivize each of the resulting generalised quantifiers just as we did for *John sneezed* in (431), exhaustive interpretations of (436a) and (436b) end up as (437) and (438), respectively. (Cf. the exhaustification of *John sneezed* in (432).)

(435) What happened?

- (436) a. Alena broke her skis.
 b. She lost her main transportation means.

(437) $\exists e_1[||\text{Alena broke her skis}||(e_1) \wedge \forall e'_1[\text{happened}(e'_1) \leftrightarrow e_1 = e'_1]]$

(438) $\exists e_2[||\text{She lost her main transportation means}||(e_2) \wedge \forall e'_2[\text{happened}(e'_2) \leftrightarrow e_2 = e'_2]]$

The conjunction of (437) and (438) is in turn equivalent to (439),¹⁸ which states that there is only one event that happened and that event was both a

¹⁷In particular, sentential restatements are analogous to nominal restatements that involve two indefinite descriptions such as (397b) and (397c) in Section 5.2.

¹⁸The inference is parallel to that in Appendix A.3.4.

ski-breaking and a loss of her main transportation means by Alena. That is, the event descriptions in (436a) and (436b) are indeed predicted to refer to the same event.

- (439) $\exists e[\text{||Alena broke her skis||}(e) \wedge$
 $\text{||She lost her main transportation means||}(e) \wedge$
 $\forall e'[\text{happened}(e') \leftrightarrow e = e']]$

Note that just like in the case of nominal restatements, the inference of coreference does not depend on the descriptive content of the sentences as long as it is clear that they form distinct utterances and these utterances answer the same question, cf. Section 4.3.3. This is an advantage of the current approach over the proposal of Danlos (1999), cf. Chapter 2, pp. 46–49. According to Danlos, event coreference is inferred on the basis of lexical relations, which limits her account to cases where parts of one sentence stand in a synonymy or hyponymy/hyperonymy relation with parts of the other.¹⁹ By contrast, in the current approach coreference is always inferred, regardless whether the event descriptions stand in one of the lexical relations or are simply compatible as in (439). Of course, this means that coreference is also inferred when the event descriptions are incompatible. In such discourses the resulting contradiction explains their infelicity.²⁰ Let's consider for instance Asher and Lascarides' (2003, pp. 181–183, 199–204) example once again, cf. (440)–(441).

(440) What did Kim do today?

- (441) a. Kim watched TV.
 b. ?? She studied.

Assuming that (442) is the question predicate, the sentences (441a) and (441b) are interpreted exhaustively as in (443) and (444), respectively. As one would expect, (443) states that Kim watched TV and that was the only thing Kim did today. Similarly, (444) states that studying was the only thing Kim did. Following the same line of argumentation as before, the conjunction of these two statements entails that Kim's watching TV and Kim's studying are the same thing, namely the one thing that Kim did today, cf. (445).

(442) $\lambda e[\text{do}(k, e) \wedge \text{today}(e)]$

(443) $\exists e_1[\text{||Kim watched TV||}(e_1) \wedge \forall e'_1[\text{do}(k, e'_1) \wedge \text{today}(e'_1)] \leftrightarrow e_1 = e'_1]]$

(444) $\exists e_2[\text{||She studied||}(e_2) \wedge \forall e'_2[\text{do}(k, e'_2) \wedge \text{today}(e'_2)] \leftrightarrow e_2 = e'_2]]$

(445) $\exists e[\text{||Kim watched TV||}(e) \wedge \text{||She studied||}(e) \wedge$
 $\forall e'[\text{do}(k, e') \wedge \text{today}(e')] \leftrightarrow e = e']]$

But Kim's watching TV and Kim's studying are not the same thing and cannot refer to the same activity. As our world knowledge tells us, it is unlikely that these two activities occur simultaneously, and seems even more unlikely that someone would study *in that* he or she watches TV. Hence, (445) is inconsistent with world knowledge, and this is the reason why (441) is infelicitous.

¹⁹See, in particular, the discussion of example (104) in Chapter 2, p. 48.

²⁰This prediction might appear too strong, since it almost says that coreference of main eventualities is the only possible semantic relation between two sentences. I will return to this question in Chapter 7.

Of course, one could imagine a situation in which the subject of Kim’s study is some TV programme. In that case Kim could study *in* watching TV, but then (441) would not be odd anymore. It is the situation itself that is odd in that case so it does not appear to be an accessible interpretation possibility, and (441) is readily rejected.

Note that the way in which we inferred the infelicity of (441) is again completely parallel to the strategy we used in nominal restatements consisting of two incompatible indefinite descriptions such as (447). In both cases a contradiction is involved. But of course we are not able to account in this way for the observation that the resulting infelicity of nominal restatements is really bad, whereas sentential restatements like (441) are often just a little odd. This difference would need an independent explanation.

(446) Who snores?

(447) # A child. An adult.

Apart from that, the proposed theory of restatements already does quite a good job. With the help of Groenendijk and Stokhof’s notion of exhaustification and the extension to question-answer pairs involving questions about events developed in this section, we are able to reproduce the predictions wrt. event coreference in sentential restatements using largely the same mechanisms as those responsible for the coreference of individuals in nominal restatements, cf. Section 5.2. In this way the theory accounts for the apparent parallelism in behaviour of restatements of both kinds, cf. Section 4.2.2. However, so far we have only been concerned with the simplest cases—singular NPs and sentences describing simple (atomic) events. Besides, until now the proposed theory has had nothing to say about the role of an overt conjunction, e.g. *and*, in “cancelling” the coreference effect, cf. pp. 159–161. These issues will be addressed in Sections 5.4 and 5.5, after we come to terms with the exhaustive interpretation of pluralities—descriptions of complex individuals and complex events.

5.4 Complex objects and the meaning postulates

The focus of this section is on restatements that involve complex individuals and complex events, such as (449) and (451). A complex individual is a sum (\oplus) of multiple atomic individuals. For instance, *John and Mary* ($j \oplus m$) is a complex individual that consists of *John* (j) and *Mary* (m). Similarly John’s opening the door (e) can be viewed as a complex event—a sum of unlocking the door (e_1) and pushing it (e_2), i.e. $e = e_1 \oplus e_2$.²¹

(448) Who snores?

(449) Two linguists. John and Mary.

(450) What happened?

²¹I am using the standard notion of \oplus -sum and mereological part-whole relations between events and individuals (Link, 1983; Krifka, 1989; Kamp and Reyle, 1993; Eckardt, 1998). Krifka’s axiomatisation of event mereology is given in Appendix A.1; Kamp and Reyle’s axiomatisation based more closely on Link (1983) is given in Appendix B.1.1.

- (451) a. John opened the door.
 b. He unlocked it and pushed it.

Coreference is a characteristic feature for this class of restatements as well, but this time we are talking about coreference of complex objects. For instance, the complex event denoted by (451a) corefers with the complex event denoted by (451b), which in turn makes the hearer recognise proper part relations between the described events, e.g. unlocking the door is understood as part of opening the door. In other words, relational theories of discourse such as RST or SDRT would classify the relation between (451a) and the conjuncts of (451b) as elaboration—a special case of restatement in our view.

Of course, our purpose is to infer the coreference relation between the complex objects in discourses like (449) and (451) from their exhaustive interpretations just as we did before. However, it is well-known that in certain verbal contexts the exhaustification of plurals (or complex objects in our current terminology) faces serious difficulties in Groenendijk and Stokhof’s theory. Usually these difficulties are discussed in connection with distributive contexts, but as we will see below, the problem is much more general and can arise with all sorts of meaning postulates in models based on structured domains. This problem also carries over to restatements, hence some solution has to be provided before the discourses (449) and (451) can be analysed.

5.4.1 The problem

One of the motivations for introducing structured domains in natural language semantics was the need to account for the observation that a sentence like *John and Mary can lift a piano* generally does not entail that John can lift a piano and Mary can lift a piano (alone):

- (452) John and Mary can lift a piano $\not\Leftarrow$
 John can lift a piano and Mary can lift a piano

The idea is that John and Mary (453) as a group and John and Mary as two separate individuals are not the same thing. In other words, the NP is ambiguous between a *collective* (454a) and a *distributive* reading (454b) and the whole sentence (455) receives two distinct interpretations accordingly, cf. e.g. Kamp and Reyle (1993, p. 328). On the collective reading, the predicate *can lift a piano* applies to the collection consisting of John and Mary—the complex object $j \oplus m$, cf. (456a). On the distributive reading, the predicate is “distributed” over the atomic individuals, cf. (456b). Only in the latter case is the above mentioned entailment valid.

- (453) John and Mary.

- (454) a. $\lambda P[P(j \oplus m)]$
 b. $\lambda P[P(j) \wedge P(m)]$

- (455) John and Mary can lift a piano.

- (456) a. $\|\text{can lift a piano}\|(j \oplus m)$
 b. $\|\text{can lift a piano}\|(j) \wedge \|\text{can lift a piano}\|(m)$

At the same time, there is a large class of predicates which do not give rise

to ambiguity of this sort. One of them is the verb *snore*. Obviously, John and Mary snore if and only if John snores and Mary snores (457). Such predicates are called distributive since, in a way, they are “distributed” obligatorily.

(457) John and Mary snore \Leftrightarrow
 John snores and Mary snores

In a model with a structured domain of individuals, the interpretation of distributive predicates has to be constrained by meaning postulates in order to get rid of the ambiguity introduced by the NP’s semantics. However, there seem to be at least two ways in which the distributivity postulate can be formulated. One way is to require that a distributive predicate P contain the collective object $x \oplus y$ whenever it contains the atoms x and y , and vice versa, cf. (458).²² In this case P is closed under summation, so I will call this a *summative* approach to distributivity. Under this approach it does not matter which reading, collective or distributive, the NP takes—the resulting propositions will be true in the same models.

(458) $Distr(P) \Leftrightarrow \forall x, y \in D[P(x) \wedge P(y) \leftrightarrow P(x \oplus y)]$

Alternatively, distributivity can be viewed as a restriction to *atomic* objects, cf. (459). This approach is adopted for instance by Link (1983, p. 133),²³ as well as Kamp and Reyle (1993). “Atomically” distributive predicates only make sense when combined with the distributive meaning of the NP, such as (454b). If the NP is interpreted collectively (454a), the resulting proposition is always false. For example, if the NP *John and Mary* is interpreted as $\lambda P[P(j \oplus m)]$, then the sentence *John and Mary snore* would be represented as $snore(j \oplus m)$. But this is false in all models if *snore* is assumed to be distributive in the sense of atomic distributivity, since $\neg Atom(j \oplus m)$. Thus we get rid of the unwanted ambiguity by excluding one of the readings on semantic grounds, rather than blurring the two readings together.

(459) $Distr(P) \Leftrightarrow \forall x[P(x) \rightarrow Atom(x)]$

Depending on the assumed notion of distributivity, Groenendijk and Stokhof’s exhaustification leads to different kinds of problems, but problems arise in both cases. The fallacy of the summative approach is most blatant. Regardless of whether the exhaustivized NP is interpreted collectively or distributively, the exhaustification with respect to a distributive question predicate is always inconsistent in this approach. For example, if the NP *John and Mary* gets a collective reading as in (460a), then its exhaustive interpretation wrt. to the question *Who snores?* (460c) states that the collective object $j \oplus m$ is the only object that has the property *snore*. But this entails that neither of the atoms j or m has this property, that is $\neg snore(j)$ and $\neg snore(m)$, which contradicts the assumption that *snore* is summatively distributive (458).

²²This notion of distributivity is assumed, for instance, by Bonomi and Casalegno (1993, p. 5) or van Rooij and Schulz (2004b, fn. 14 on p. 11), but it is not very common in the literature on plurals.

²³All page numbers for Link (1983) refer to the reprinted version in Portner and Partee (2002).

- (460) a. $\|\text{John and Mary}\| = \lambda P[P(j \oplus m)]$
 b. $\text{EXH}(\|\text{John and Mary}\|) = \lambda P \forall x [P(x) \leftrightarrow [x = j \oplus m]]$
 c. $[\text{EXH}(\|\text{John and Mary}\|)](\text{snore}) = \forall x [\text{snore}(x) \leftrightarrow [x = j \oplus m]]$

If *John and Mary* is in turn interpreted distributively (461a), then after exhaustification, the extension of *snore* only includes the atomic objects *j* and *m*, and excludes $j \oplus m$, cf. (461c).²⁴ This again is inconsistent with the distributivity of *snore*.

- (461) a. $\|\text{John and Mary}\| = \lambda P[P(j) \wedge P(m)]$
 b. $\text{EXH}(\|\text{John and Mary}\|) = \lambda P \forall x [P(x) \leftrightarrow [x = j \vee x = m]]$
 c. $[\text{EXH}(\|\text{John and Mary}\|)](\text{snore}) = \forall x [\text{snore}(x) \leftrightarrow [x = j \vee x = m]]$

If we adopt the atomic approach to distributivity (459), at first glance the situation improves considerably. The collective reading of the NP is excluded anyway, and the exhaustive interpretation of the distributive reading (461c) is perfectly compatible with the postulate (459). In fact, this is the solution that Groenendijk and Stokhof (1984, pp. 416–417) themselves alluded to. But this solution also has serious limitations.

In the case of *snore*, we do not seem to lose anything by switching from the summative to the atomic notion of distributivity. However, there are other predicates for which this step would be less justified. Consider, for instance, the question predicates of (462) and (463). Obviously, if something is in the box, then all its parts down to molecules and atoms (in the physical sense) are in that box, too, cf. (464). But if this observation were to be captured in terms of atomic distributivity then the only consistent way to do this would be to assume that it is the physical atoms that are in the box rather than the cards or the deck of cards itself. This is not only counterintuitive but also presupposes that any object (or portion of matter) can be represented as a sum of atoms. Even if this makes sense in physics, the linguistic relevance of such a model is questionable. For instance, it is a standard assumption in semantics that mass terms such as *sugar* have *cumulative* reference, or in our terms, should be viewed as distributive in the summative sense. That is, if two portions of stuff are sugar then their sum is sugar, too, and vice versa, any amount of sugar can be divided into portions that qualify as sugar, as well, cf. Link (1983, pp. 129–130) or Krifka (1989, p. 75). However, if the predicates *in the box* and *sugar* are analysed as summatively distributive, the exhaustive interpretation of answers to questions (462) and (463) would be inconsistent for the same reasons as in the case of *snore*.

(462) What is in the box?

(463) Which is sugar?

(464) A deck of cards is in the box \Rightarrow

Four aces, four kings, etc. are in the box \Rightarrow

Every bit of matter that makes up those cards is in the box

Unfortunately, the predicate *happen* is similar to predicates like *in the box* in terms of the meaning postulates associated with it. Clearly, *happen* is a distributive predicate: if an event happened, then all of its subevents must have

²⁴The statement (461b) follows from Groenendijk and Stokhof's theory, cf. Appendix A.3.2.

happened as well. This can be expressed rather naturally in terms of summative distributivity, but if we were to define *happen* as atomically distributive, i.e. as a set containing *only* the atomic happenings, then we would have to commit ourselves to the view that there *is* such a thing as an atomic happening, which is even more controversial than reconstructing sugar as a set of indivisible particles of sugar.²⁵

In other words, even if for some question predicates such as *snore* we can get sensible exhaustifications by switching to the atomic notion of distributivity, other predicates may indeed require summative distributivity, which gives rise to the problems with exhaustification discussed above. Thus we need to find an independent solution to these problems, one that does not make us choose between the two notions of distributivity. But before we turn to the discussion of a possible solution, let's consider the negative consequences that these problems have for the proposed theory of restatements.

Consider example (450)–(451) again, repeated in (465)–(466) below. Assuming that *happen* is distributive in the summative sense and that (466a) refers to a complex event of door opening, the exhaustive interpretation of (466a) would reduce the extension of the question predicate *happen* to that complex event alone, i.e. it would predict that none of its subparts (e.g. unlocking and pushing, or any other subevents) took place. This would contradict the distributive character of *happen*. In other words, we arrive at a contradiction even before the second part (466b) is processed. In contrast, if (466a) referred to an atomic event, its exhaustive interpretation would be consistent. However, in that case it could not be coreferential with the complex event described by (466b). But if the main eventualities of (466a) and (466b) may not corefer, the whole discourse (466) would be predicted to be inconsistent.

(465) What happened?

(466) a. John opened the door.
 b. He unlocked it and pushed it.

This shows that Groenendijk and Stokhof's approach to exhaustification "as is" cannot be effectively used as a basis for the proposed theory of restatement, until the problem of meaning postulates in structured domains is fixed. In the next subsection I briefly discuss a proposal towards solving this problem.

5.4.2 A possible solution

A possible way to approach the problems discussed above is to make the exhaustification operator itself "aware" of the domain structure and/or the meaning postulates. A rather general solution based on this idea is provided by van Rooij and Schulz (2004b), which will be presented in due course (cf. Chapter 6). In order to stay close to Groenendijk and Stokhof's original proposal for the moment, here I will briefly introduce one of the possible corrections to Groenendijk and Stokhof (1990) discussed by Bonomi and Casalegno (1993, pp. 6–7). The solution provided by this correction is rather technical and not very general,

²⁵Note that it does not matter whether or not the subevents of e.g. walking still count as walking. What matters is that they are still in the extension of the question predicate *happen*, i.e. that they are simply *happenings*.

e.g. it can only handle collective readings of NPs, such as (454a),²⁶ and fails on question predicates distributive in the atomic sense.²⁷ However, as long as we stick to the summative notion of distributivity, this approach makes reasonable predictions for conjunctions of proper names and plural indefinite descriptions. In other words, it is good enough for demonstrating how a theory of exhaustification like Groenendijk and Stokhof’s would cope with restatements that involve complex objects if the problem of meaning postulates were solved.

Bonomi and Casalegno change the definition of the exhaustification operator in such a way that it respects the part-whole relations that hold between the individuals and events in the domain, i.e. ‘only x ’ means x and possibly parts of x and nothing else. Technically this is done as follows. First, Bonomi and Casalegno define an auxiliary operator that takes all singleton sets of individuals (atomic or complex) in the input quantifier and puts them into one set of individuals, i.e. in addition to filtering out the minimal sets of individuals, this operator “flattens” the quantifier, makes a set of individuals out of a set of sets of individuals. I will dub this operator as $B\&C$ here. The formal definition in set notation and in functional notation is given in (467).

$$(467) \text{ a. } B\&C(Q) = \{x | \{x\} \in Q\}$$

$$\text{ b. } B\&C(Q) = \lambda x \exists P [Q(P) \wedge \forall y [P(y) \leftrightarrow y = x]]$$

In the next step, requires that the exhaustive quantifier $\text{EXH}_{B\&C}(Q)$ contain sets of individuals that include elements of $B\&C(Q)$ and their parts (subgroups), as defined in (468).

$$(468) \text{ a. } \text{EXH}_{B\&C}(Q) = \{P | \exists x \in B\&C(Q) [x \in P \wedge \forall y \in P [y \leq x]]\}$$

$$\text{ b. } \text{EXH}_{B\&C}(Q) = \lambda P \exists x [[B\&C(Q)](x) \wedge P(x) \wedge \forall y [P(y) \rightarrow y \leq x]]$$

This trick provides much more practicable exhaustifications for NPs referring to complex individuals answering questions whose question predicate is distributive in the summative sense. Consider, for instance, *John and Mary* (469) in its collective reading as an answer to the question *Who is in the room?* The question predicate *in the room* has similar properties as the predicate *in the box* discussed earlier. That is, if John and Mary are in the room then John is in the room, too, as well as John’s legs and arms, and every molecule and atom constituting John’s body. But now the exhaustive interpretation in (469c) does not lead to the erroneous entailment that only “the whole of” John and Mary is in the room, rather than John or Mary individually. Instead, it is predicted that whatever is in the room must be identical to or part of $j \oplus m$.²⁸ Thus, even if John and Mary themselves are conceived of as complex individuals consisting of their body parts and ultimately atoms in the physical sense, the exhaustification in (469c) takes care of this possibility.

²⁶See Appendix A.4.6 for examples of the implausible predictions for distributive readings.

²⁷This is by no means an essential limitation of the approach, but rather an accidental consequence of Bonomi and Casalegno’s definition. See, for instance, Bonomi and Casalegno (1993, p. 8) for their own correction which fixes part of the problem, but is less simple and even more technical. Another approach is to combine Groenendijk and Stokhof’s original definition of EXH with a series of distributivity and materialisation operators working on the quantificational NP. I will not discuss these alternatives here. For the purpose of demonstrating the potential of Groenendijk and Stokhof’s approach as applied to restatements, Bonomi and Casalegno’s first version of the definition will suffice.

²⁸The full inference can be found in Appendix A.4.3.

- (469) a. $\|\text{John and Mary}\| = \lambda P[P(j \oplus m)]$
 b. $\text{EX}_{HB\&C}(\|\text{John and Mary}\|) = \lambda P[P(j \oplus m) \wedge \forall z[P(z) \rightarrow z \leq j \oplus m]]$
 c. $[\text{EX}_{HB\&C}(\|\text{John and Mary}\|)](\|\text{in the room}\|) =$
 $\|\text{in the room}\|(j \oplus m) \wedge \forall z[\|\text{in the room}\|(z) \rightarrow z \leq j \oplus m]$

The exhaustification of plural indefinites works similarly. For instance, (470) shows the exhaustification of the collective reading of the NP *two linguists*.²⁹ Again, the exhaustive interpretation wrt. *in the room* says that two linguists and all parts thereof are in the room, but nothing else.

- (470) a. $\|\text{two linguists}\| =$
 $\lambda P\exists x\exists y[x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge P(x \oplus y)]$
 b. $\text{EX}_{HB\&C}(\|\text{two linguists}\|) =$
 $\lambda P\exists x\exists y[x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge P(x \oplus y) \wedge$
 $\forall z[P(z) \rightarrow [z \leq x \oplus y]]]$
 c. $[\text{EX}_{HB\&C}(\|\text{two linguists}\|)](\|\text{in the room}\|) =$
 $\exists x\exists y[x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \|\text{in the room}\|(x \oplus y) \wedge$
 $\forall z[\|\text{in the room}\|(z) \rightarrow [z \leq x \oplus y]]]$

Notice that using this mechanism we can also safely exhaustivize singular NPs that refer to complex individuals, e.g. *a deck of cards*, as well as sentences that refer to complex events. For instance, (471) presents the exhaustification of the answer *John opened the door* to the question *What happened?*, which did not work in Groenendijk and Stokhof's original setting if assumed that a complex event is involved, cf. p. 191. Now the exhaustive interpretation (471d) is consistent even if *e* is non-atomic since all (471d) says is that an event of John opening the door happened, and whatever else happened was a subevent of that.

- (471) a. $\|\text{John opened the door}\| = \lambda e[\|\text{John opening the door}\|(e) \wedge \text{happen}(e)]$
 b. $\text{EQS}(\|\text{John opened the door}\|) =$
 $\lambda P\exists e[\|\text{John opening the door}\|(e) \wedge \text{happen}(e) \wedge P(e)]$
 c. $\text{EX}_{HB\&C}(\text{EQS}(\|\text{John opened the door}\|)) =$
 $\lambda P\exists e[\|\text{John opening the door}\|(e) \wedge \text{happen}(e) \wedge \forall e'[P(e') \rightarrow e' \leq e]]$
 d. $[\text{EX}_{HB\&C}(\text{EQS}(\|\text{John opened the door}\|))](\text{happen}) =$
 $\exists e[\|\text{John opening the door}\|(e) \wedge \text{happen}(e) \wedge \forall e'[\text{happen}(e') \rightarrow e' \leq e]]$

Thus Bonomi and Casalegno provide a mechanism that solves the problem of summative distributivity for various sorts of descriptions of complex objects. This will be enough to continue our discussion of restatements.

5.4.3 Restatements with complex objects

With the correction proposed by Bonomi and Casalegno (1993, pp. 6–7), Groenendijk and Stokhof's notion of exhaustification already provides quite satisfactory results for restatements that involve complex individuals and complex events. Let's consider nominal restatements first. Recall the examples (331a) and (332a) from Section 4.2.2, repeated as (473a) and (473b) below. In both cases the hearer infers that the two pairs of individuals corefer, i.e. John and Mary are the two linguists who snore (473a), and similarly in (473b), one of the

²⁹The full inference can be found in Appendix A.4.5.

two linguists who snore is a student and the other one is a professor. Recall also that, according to the proposed theory, whenever two NPs are not connected intonationally or by a conjunction *and*, exhaustification takes narrow scope over each NP individually, and the results of exhaustification are conjoined (cf. (384a) in Section 4.3.3). Finally, from now on I will assume that all predicates that we might like to call distributive—be that *snore*, *in the box*, or *happen*—are distributive in the summative sense (458). Given these assumptions, I will now investigate the predictions of the proposed theory of restatements using $\text{EXH}_{B\&C}$ as the exhaustification operator.

(472) Who snores?

- (473) a. Two linguists. John and Mary.
 b. Two linguists. A student and a professor.

First consider (473a). The exhaustive interpretations of the NPs *two linguists* and *John and Mary* are like those given in (470c) and (469c) in the previous section, the only difference being that the question predicate *in the room* is replaced by *snore*. The conjunction of the two exhaustifications gives (474). This statement says that only two linguists snore, and whoever else snores must be part of (or identical to, \leq) those two linguists; it also says that only John and Mary snore, and whoever else snores must be part of John and Mary. Hence we infer that John and Mary are a (non-proper) part of the two linguists that snore, and those two linguists are a (non-proper) part of John and Mary. This can be fulfilled only if both pairs of individuals are identical. Finally, we can infer that (474) is equivalent to (475). (A complete inference is given in Appendix A.4.7.)

$$(474) \exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \text{snore}(x \oplus y) \wedge \\ \forall z [\text{snore}(z) \rightarrow [z \leq x \oplus y]]] \wedge \\ \text{snore}(j \oplus m) \wedge \forall z [\text{snore}(z) \rightarrow z \leq j \oplus m]$$

$$(475) \exists x \exists y [x \oplus y = j \oplus m \wedge x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \\ \text{snore}(x \oplus y) \wedge \forall z [\text{snore}(z) \rightarrow [z \leq x \oplus y]]]$$

The discourse in (473b) is analysed in a similar way. Assuming that the coordinated structure *a student and a professor* receives a semantics as in (476a),³⁰ the exhaustive interpretation of the NP with respect to the question predicate *snore* results in (476c). One can show that its conjunction with the exhaustive interpretation of *two linguists* leads to the statement in (477), which entails that the two linguists ($x \oplus y$) and the two individuals one of which is a student and the other is a professor ($x' \oplus y'$) corefer ($x \oplus y = x' \oplus y'$).

³⁰More will be said about how the meaning of a coordinated NP is composed of the meanings of the conjuncts in Section 5.5.

- (476) a. $\| \text{a student and a professor} \| =$
 $\lambda P \exists x \exists y [\text{student}(x) \wedge \text{professor}(y) \wedge P(x \oplus y)]$
- b. $\text{EX}_{HB\&C}(\| \text{a student and a professor} \|) =$
 $\lambda P \exists x \exists y [\text{student}(x) \wedge \text{professor}(y) \wedge P(x \oplus y) \wedge$
 $\forall z [P(z) \rightarrow [z \leq x \oplus y]]]$
- c. $[\text{EX}_{HB\&C}(\| \text{a student and a professor} \|)] (\| \text{snore} \|) =$
 $\exists x \exists y [\text{student}(x) \wedge \text{professor}(y) \wedge \text{snore}(x \oplus y) \wedge$
 $\forall z [\text{snore}(z) \rightarrow [z \leq x \oplus y]]]$
- (477) $\exists x \exists y \exists x' \exists y' [x \oplus y = x' \oplus y' \wedge x \neq y \wedge$
 $\text{linguist}(x) \wedge \text{linguist}(y) \wedge$
 $\text{student}(x') \wedge \text{professor}(y') \wedge$
 $\text{snore}(x \oplus y) \wedge \forall z [\text{snore}(z) \rightarrow [z \leq x \oplus y]]]$

Note that (475) and (477) only say that John and Mary or a student and a professor form a group of two linguists jointly. Thus if we allow for the possibility that human individuals are non-atomic, the above statements do not immediately entail that Mary is a linguist, John is a linguist, a student is a linguist and a professor is a linguist individually.³¹ However, this can easily be achieved by additionally assuming a meaning postulate that guarantees that a group (sum) of individuals can be partitioned into, let's say, persons (elements of the predicate *person*) in a unique way, if at all. Further meaning postulates and world knowledge will make sure that every linguist, student or professor is a person, as well as that John and Mary are persons. Then the coreference of the groups' elements can be inferred from the coreference of the whole groups in (475) and (477).

Note also that the adopted definition of exhaustification and the derivation outlined above lead to proper identity of the groups, rather than e.g. inclusion. This is the correct result for discourses like (478)–(479), where the unequal size of the groups *three linguists* and *John and Mary* leads to infelicity, i.e. a reading where John and Mary are understood as two of the three given linguists is apparently not available, cf. examples (359c) and (359d) in Section 4.2.2. Assuming that the NP *three linguists* is analysed along the same lines as *two linguists* in (470), the conjunction of the exhaustive interpretations of the two NPs $[\text{EX}_{HB\&C}(\| \text{three linguists} \|)] (\text{snore}) \wedge [\text{EX}_{HB\&C}(\| \text{John and Mary} \|)] (\text{snore})$ is equivalent to the statement in (480). The statement says that a group of three linguists $x \oplus y \oplus z$ is identical to the group of John and Mary $j \oplus m$, which is impossible due to the same meaning postulates related to the predicate *person* as those mentioned above. A group of three persons cannot be equal to a group of two persons, hence (480) is contradictory. Thus the infelicity of (479) is explained by its inconsistency, just like in other restatements that involve incompatible descriptions, see e.g. the analysis of (397c) in Section 5.2.

(478) Who snores?

(479) # Three linguists. John and Mary.

³¹For instance, the statement in (475) does not exclude the absurd situation in which part of Mary plus part of John forms one linguist, whereas the rest of Mary plus the rest of John forms the other linguist.

- (480) $\exists x \exists y \exists z [x \oplus y \oplus z = j \oplus m \wedge x \neq y \wedge x \neq z \wedge y \neq z \wedge$
linguist(x) \wedge linguist(y) \wedge linguist(z) \wedge
snore(x \oplus y \oplus z) \wedge \forall z' [snore(z') \rightarrow [z' \leq x \oplus y \oplus z]]]

Of course, this approach would also predict that discourses like (482) and (484), where the “smaller” group (in second position) is introduced by a quantificational NP, are as infelicitous as (479). On the contrary, in English, (482) is perceived as less inappropriate than (479), whereas in Russian, (484) is perfect. Thus the proposed theory makes wrong predictions for such cases. However, as I argued in Section 4.2.2 (see the discussion of (302b) and (304b)), other processes related to the nature of quantificational NPs could be at work here. In other words, there is enough reason to treat such NPs as exceptional. The extension of the current proposal for such exceptions has to be left for the future.

(481) Who snores?

(482) ? Three linguists. Two phonologists.

(483) Kto xrapit?
 who snores

(484) Tri lingvista. Dva fonologa.
 three linguists two phonologists

The examples discussed so far illustrate the predictions of the present approach for nominal restatements. The coreference requirement is inferred in all these cases, obviously, regardless of the order of the NPs. As before, the idea is that Russian nominal restatements receive the same analysis as the English ones, which explains the similarities in the linguistic properties of restatements in both languages. Thus all the main phenomena related to asyndetically connected NPs discussed in Section 4.2.2 have been covered. In order to complete the analysis of asyndetically connected utterances in general, let’s finally consider sentence restatements that involve complex events.

For instance, consider (465)–(466), repeated below. Assuming that the conjunction of clauses in (486b) receives the literal and exhaustive interpretations given in (487),³² combining the exhaustive interpretations of (486a) and (486b) (the former given in (471d) earlier) ultimately results in (488). This in turn entails that the event of John’s opening the door (*e*) is coreferential with the complex event $e_1 \oplus e_2$ —a sum of John’s unlocking the door (e_1) and pushing it (e_2).

(485) What happened?

(486) a. John opened the door.
 b. He unlocked it and pushed it.

³²See Section 5.5 for details on how the literal meaning of the conjunction (487a) is composed of the meanings of the conjuncts. The inference of (487b) goes along the same lines as for the exhaustive interpretation of conjoined indefinite descriptions like *a student and a professor*, cf. (476c).

- (487) a. $\|\text{he unlocked it and pushed it}\| = \lambda e \exists e_1 \exists e_2 [e = e_1 \oplus e_2 \wedge$
 $\|\text{he unlocked it}\|(e_1) \wedge \|\text{he pushed it}\|(e_2) \wedge \text{happen}(e)]$
 b. $[\text{EXH}_{B\&C}(\text{EQS}(\|\text{he unlocked it and pushed it}\|))](\text{happen}) =$
 $\exists e_1 \exists e_2 [\|\text{he unlocked it}\|(e_1) \wedge \|\text{he pushed it}\|(e_2) \wedge$
 $\text{happen}(e_1 \oplus e_2) \wedge \forall e' [\text{happen}(e') \rightarrow [e' \leq e_1 \oplus e_2]]]$
- (488) $\exists e \exists e_1 \exists e_2 [e = e_1 \oplus e_2 \wedge$
 $\|\text{John opened the door}\|(e) \wedge \|\text{he unlocked it}\|(e_1) \wedge \|\text{he pushed it}\|(e_2) \wedge$
 $\text{happen}(e) \wedge \forall e' [\text{happen}(e') \rightarrow e' \leq e]]$

The derivation of this result follows the same logic as in the previous examples: since *John opened the door* is the exhaustive answer to the question *What happened?*, the event e of John's opening the door is the only thing that happened. Whatever else happened must be identical to or part of it. Hence the complex event $e_1 \oplus e_2$ of John's unlocking and pushing the door must be part of e . But since (486b) is also an exhaustive answer to the question *What happened?*, we infer in the same way that e (opening) must be part of $e_1 \oplus e_2$ (unlocking and pushing). But this in turn can only be fulfilled if the events are identical, i.e. $e_1 \oplus e_2 \leq e \wedge e \leq e_1 \oplus e_2$ iff $e = e_1 \oplus e_2$. Hence John's opening the door is a sum of his unlocking and pushing it.

Notice that it follows from $e = e_1 \oplus e_2$ in (488) that the event of unlocking the door, as well as the pushing event, is part of the opening event ($e_1 \leq e$ and $e_2 \leq e$). In the framework of SDRT, this would imply that the discourse relation of *Elaboration* is established between (486a) and the conjuncts of (486b). However, in SDRT one is forced to assume the existence of a fixed inventory of (ontologically primitive) discourse relations (of which *Elaboration* is one) in order to perform the inference in question, whereas in the current approach no such assumption has to be made. Elaboration falls out from the theory as a side effect of restatement, which in turn is a consequence of exhaustive interpretation.

However, not all instances of SDRT *Elaboration* would be treated in the same way. For example, (490) adapted from Lascarides and Asher (1993) is standardly analysed in SDRT as *Elaboration*. Since drawing plans is a typical preparatory phase of building, a part-whole and hence an *Elaboration* relation is inferred (cf. Chapter 2, p. 47). However, this analysis fails to capture the observation discussed in Chapter 3, pp. 101–103, that the interpretation and the felicity of (490) depends on its intonation.

(489) What's new in town?

- (490) a. The council built the bridge.
 b. The architect drew up the plans.

In particular, if both sentences are uttered with a completion tune, as in (491), and (crucially!) the discourse has no continuation, then it is rather odd altogether. It suggests that drawing up the plans is all the building of the bridge consisted in, which can at best be understood as an ironic way of saying that the bridge was actually never built. By contrast, in (492), where the second sentence is uttered with a continuation tune, drawing the plans is most naturally interpreted as forming a proper part, one of the many steps of building the bridge.

- (491) a. The council built the bridge (\searrow) .
 b. # The architect drew up the plans (\searrow) .
- (492) a. The council built the bridge (\searrow) .
 b. The architect drew up the plans (\nearrow) ...

In the proposed theory however, the differences between (491) and (492) can be captured accurately. The infelicity of (491) arises from the requirement of strict coreference, in the same way as in the “three linguists” example (479). The exhaustification of (491a) and (491b) leads to the entailment that their main eventualities are identical, and it is not the case that one is just a (proper) part of the other. But this contradicts world knowledge: building a bridge involves lots of other activities in addition to drawing up the plans, i.e. the events cannot corefer. By contrast, in (492) the exhaustification of the second sentence is blocked by the continuation intonation and the strict coreference requirement does not arise—the analysis of such examples will be discussed in more detail in the next section (5.5).

In sum, the fact that the current proposal makes stronger predictions for elaboration discourses than standard SDRT is in general a positive result (an “elaboration discourse” is in our terms a restatement establishing part-whole relations between a complex event and a number of simpler events).³³ Thus with Groenendijk and Stokhof’s notion of exhaustification and taking into consideration Bonomi and Casalegno’s correction of their original definition, we were able to cover most of the agenda set up in Section 4.2.2. An analysis was provided for both nominal and sentential restatements, both involving singular objects and pluralities, and it was shown how incompatible descriptions of an individual or an event make a restatement infelicitous. The only point that has not yet been covered is the role of continuation intonation and the conjunction *and* in “cancelling” the coreference effect.

5.5 The role of intonation and the conjunction *and*

In the previous sections it was shown how the proposed theory of restatement based on Groenendijk and Stokhof’s approach to exhaustification (or its modification by Bonomi and Casalegno) explains the coreference effect in pairs of NPs or sentences with no intonational, syntactic or lexical cues of connection between them. In particular, we considered discourses like (494) and (496), where both NPs/sentences bear a falling intonation of a complete statement (\searrow), and no overt conjunction, such as *and*, appears between them.

- (493) Who snores?
- (494) A linguist (\searrow) . Mary (\searrow) .

³³The simple notion of event coreference modelled by the current approach is, of course, too crude for some other instances of elaboration discussed in Chapter 2, pp. 101–103—those involving the notion of “zoom level.” An account of zoom obviously requires an appropriate notion of relevance. A relevance-sensitive version of exhaustification will be presented in Chapter 6, but it will not be accommodated for such cases. Solving this problem remains a task for the future.

(495) What happened?

(496) Alena broke her skis (\searrow) .

She lost her main means of transportation (\searrow) .

The focus of this section is on the contrasts between (494) and (498), and (496) and (500), respectively. The question we now want to answer is what role the presence of an overt conjunction *and*, as well as continuation (list) intonation play in the interpretation of such discourses. Recall the observation made in Section 4.2.2 that neither the conjunction nor the list intonation give rise to any coreference requirement for the conjuncts or the elements of the list. Whereas in (494) the NPs *a linguist* and *Mary* must refer to the same individual, in (498a) and (498b) this is not necessary, and normally even impossible. Similarly, whereas the asyndetically connected sentences (496) are interpreted as describing the same eventuality, in (500a) and (500b) this need not be the case. Alena might have broken her skis, and apart from that lost her main transportation means, e.g. her car.³⁴

(497) Who snores?

(498) a. A linguist (\nearrow) and Mary (\searrow) .

b. A linguist (\nearrow) , Mary (\nearrow) , ...

(499) What happened?

(500) a. Alena broke her skis (\nearrow)

and she lost her main means of transportation (\searrow) .

b. Alena broke her skis (\nearrow) ,

she lost her main means of transportation (\nearrow) , ...

We also expect an account of the above examples to immediately give us an account of the differences in acceptability of the (a) and (b) versions in the examples below. Recall that the infelicity of (502a) and (504a) was traced back to a contradiction between the coreference requirement associated with asyndetic connection on the one hand and the lexical content of the NPs/sentences, incompatible with their coreference, on the other hand. Hence, whatever blocks the coreference requirement in the overtly conjoined case should also get rid of the contradiction and make the discourses felicitous.

(501) Who snores?

(502) a. # A child (\searrow) . An adult (\searrow) .

b. A child (\nearrow) and an adult (\searrow) .

(503) What did Kim do today?

(504) a. ? Kim watched TV (\searrow) . She studied (\searrow) .

b. Kim watched TV (\nearrow) , and (she) studied (\searrow) .

Finally, in this section I will provide an analysis of contrasts between (505a) and (505b), mentioned at the end of the last section. In doing so, I will cover all the remaining instances of parallelism in the linguistic behaviour of nominal and sentential restatements discussed in Section 4.2.2.

³⁴See the discussion of the examples (348) vs. (349) and (343) vs. (337) in Section 4.2.2.

- (505) a. # The council built the bridge (\searrow) .
 The architect drew up the plans (\searrow) .
 b. The council built the bridge (\searrow) .
 The architect drew up the plans (\nearrow) .

In what follows, I will first consider the contribution of the conjunction *and* (Section 5.5.1), and then turn to intonation (Section 5.5.2).

5.5.1 The conjunction *and*

The reader might already have guessed from the analyses of the examples presented in Section 5.4³⁵ how conjunction *and* influences the exhaustive interpretation of an answer, but I will spell this out here in a more systematic way. In Section 4.3.3 I proposed that the crucial difference between asyndetic connection and overt conjunction is in the scope of exhaustification, cf. (384), which is reformulated in (506), taking into account the specifics of Groenendijk and Stokhof’s (Bonomi and Casalegno’s) definitions. The idea is that in the case of asyndetically connected units, the completion intonation on the first unit (A_1) already tells the hearer “exhaustivize now!”. The completion intonation of the second unit (A_2) does the same thing, so the exhaustification operator applies to A_1 and A_2 separately, taking narrow scope over each unit, as shown in (506a). By contrast, the conjunction *and* connects A_1 and A_2 into one utterance, and since we assumed that exhaustification only applies globally, in this case it must take wide scope over A_1 and A_2 together, cf. (506b).

- (506) a. Restatement: $[\text{EXH}_{B\&C}(A_1)](P) \wedge [\text{EXH}_{B\&C}(A_2)](P)$
 b. Conjunction: $[\text{EXH}_{B\&C}(A_1 \parallel \text{and} \parallel A_2)](P)$

The only thing that still needs to be provided is a semantics for *and* ($\parallel \text{and} \parallel$), but for that we can make use of standard definitions, e.g. Krifka (1990). It is a well-established fact that the classical Boolean conjunction \wedge (or type-shifted versions thereof) does not capture all aspects of the functioning of the natural language conjunction *and*. The Boolean conjunction reflects correctly, for instance, the distributive readings of coordinated NPs, such as $\lambda P[P(j) \wedge P(m)]$ for *John and Mary*, cf. (454b) in Section 5.4. However, in order to capture the collective readings such as $\lambda P[P(j \oplus m)]$ a different notion of conjunction is used, the so-called *non-Boolean* conjunction. A comprehensive unified account of both Boolean and non-Boolean conjunction for expressions of all semantic types can be found in Krifka (1990). In this section I will only consider non-Boolean conjunction (because of the limitation of Bonomi and Casalegno’s exhaustification to collective readings), and only the type-specific definitions for the denotation types of NPs and sentences.

Let’s consider NPs first. The definition of $\oplus_{\langle\langle e, t \rangle t \rangle}$ —non-Boolean conjunction for expressions of type $\langle\langle e, t \rangle t \rangle$ —is given in (507),³⁶ cf. Hoeksema (1988) or Krifka (1990, p. 167). The operator takes two generalised quantifiers (T and T') and returns another generalised quantifier ($\lambda P[T(\lambda y[T'(\lambda x[P(x \oplus y)])])]$), which corresponds to the collective reading of the conjoined NP.

$$(507) \oplus_{\langle\langle e, t \rangle t \rangle} = \lambda T \lambda T' \lambda P [T(\lambda y [T'(\lambda x [P(x \oplus y)])])]$$

³⁵See (469), (476) and (487) in Section 5.4.

³⁶The notation \oplus_σ is used for non-Boolean conjunction operators that conjoin expressions of type σ . Then the operator itself has type $\langle\sigma \langle\sigma, \sigma \rangle\rangle$.

For example, assuming that the natural language conjunction *and* is translated as $\oplus_{\langle\langle e,t \rangle t \rangle}$, the literal meaning of the NP *a linguist and Mary* (498a) is computed from $\|a\ linguist\| \oplus_{\langle\langle e,t \rangle t \rangle} \|Mary\|$ which ultimately leads to (508a). In other words, the semantics of *a linguist and Mary* is a set of properties that at least one linguist and Mary jointly have. The exhaustification of this quantifier with respect to the question predicate *snore* is in turn shown in (508b).³⁷ Notice that (508b) is compatible with both coreference and non-coreference of *Mary* (*m*) and the individual referred to by *a linguist* (*x*). In other words, the coreference implicature is simply not drawn (rather than e.g. being cancelled).

$$(508) \text{ a. } \|a\ linguist\ and\ Mary\| = \lambda P \exists x [linguist(x) \wedge P(x \oplus m)]$$

$$\text{ b. } [EXH_{B\&C}(\|a\ linguist\ and\ Mary\|)](snore) =$$

$$\exists x [linguist(x) \wedge snore(x \oplus m) \wedge \forall y [snore(y) \rightarrow y \leq x \oplus m]]$$

In contrast, the corresponding restatement (494) receives an interpretation according to (506a), in which the exhaustification operator takes narrow scope over each of the NPs separately, which amounts to (509).³⁸

$$(509) [EXH_{B\&C}(\|a\ linguist\|)](snore) \wedge [EXH_{B\&C}(\|Mary\|)](snore) =$$

$$linguist(m) \wedge snore(m) \wedge \forall y [snore(y) \rightarrow y \leq m]$$

Comparing (509) and (508b) makes the interpretive contrasts between asyndetically connected (494) and conjoined NPs (498a) most evident. Whereas the asyndetically connected NPs *a linguist* and *Mary* in (494) are predicted to refer to the same individual, in the conjunction (498a) this need not be the case. Of course, additional mechanisms would be needed in order to capture the fact that conjoined NPs normally have disjoint reference, and (498a) indeed refers to a group of two distinct individuals. However, the discussion of such mechanisms generally goes beyond the scope of the current study, although some related ideas will be presented in Chapter 7.

Next, the differences in the acceptability of discourses like (502a) and (502b), repeated in (511), can be reconstructed in a completely parallel fashion. E.g. (512b) represents the interpretation of (511b) using scheme (506b) and the non-Boolean conjunction (507), whereas (513) represents (511a) based on scheme (506a).³⁹ Whereas (513) is in conflict with the information that one and the same individual (*x*) cannot be a child and an adult at the same time, (512b) is compatible with this information, since nothing in (512b) implies that the properties *child* and *adult* apply to the same individual.

(510) Who snores?

$$(511) \text{ a. } \# \text{ A child } (\searrow) . \text{ An adult } (\searrow) .$$

$$\text{ b. } \text{ A child } (\nearrow) \text{ and an adult } (\searrow) .$$

$$(512) \text{ a. } \|a\ child\ and\ an\ adult\| = \lambda P \exists x \exists y [child(x) \wedge adult(y) \wedge P(x \oplus y)]$$

$$\text{ b. } [EXH_{B\&C}(\|a\ child\ and\ an\ adult\|)](snore) =$$

$$\exists x \exists y [child(x) \wedge adult(y) \wedge snore(x \oplus y) \wedge \forall z [snore(z) \rightarrow z \leq x \oplus y]]$$

³⁷See Appendix A.4.4 for complete derivation.

³⁸The interpretation of (494) based on Groenendijk and Stokhof's original definition of exhaustification was considered in Section 5.2. The inference of (509), which is based on Bonomi and Casalegno's version, is parallel to that of (473a), cf. Section 5.4 and Appendix A.4.7.

³⁹See Section 5.2 for the exhaustive interpretation of (511a) based on Groenendijk and Stokhof's original definition, (404). The inference of (513) based on Bonomi and Casalegno's version is largely parallel to that of to that of (473a), cf. Section 5.4 and Appendix A.4.7.

$$(513) [\text{EXH}_{B\&C}(\|a\text{ child}\|)](\textit{snore}) \wedge [\text{EXH}_{B\&C}(\|an\text{ adult}\|)](\textit{snore}) = \\ \exists x[\textit{child}(x) \wedge \textit{adult}(x) \wedge \textit{snore}(x) \wedge \forall y[\textit{snore}(y) \rightarrow y \leq x]]$$

These examples demonstrate the impact of the conjunction *and* on the exhaustive interpretation of answers constituted by coordinated NPs. The role played by the conjunction in coordinated sentences is largely the same, with the sole difference that in the case of sentences coordination perhaps makes more sense at the level of event properties (sentence denotations) before shifting to an existential quantifier (EQS, cf. (424) in Section 5.3). The notion of non-Boolean conjunction needed for conjoining properties is given in (514), cf. Link (1983, p. 142), Krifka (1990, p. 164).

$$(514) \oplus_{\langle e,t \rangle} = \lambda P \lambda P' \lambda e \exists e_1 \exists e_2 [P(e_1) \wedge P'(e_2) \wedge e = e_1 \oplus e_2]$$

The operator $\oplus_{\langle e,t \rangle}$ takes two properties (sets of individuals or events) P and P' and returns another property—a set of complex objects that consist of two objects, one having property P and the other P' . Of course, given the definitions in (507) and (514), technically it does not matter if the conjunction applies before or after EQS, since (515) holds.⁴⁰ However, non-Boolean conjunction of sentence denotations (before EQS) is independently motivated, for instance, in the analysis of adverbial modification, cf. Eckardt (1998).

$$(515) \forall P \forall P' [\text{EQS}(P \oplus_{\langle e,t \rangle} P') \leftrightarrow \text{EQS}(P) \oplus_{\langle \langle e,t \rangle t \rangle} \text{EQS}(P')]$$

Under these assumptions, the conjunction of the sentences *Alena broke her skis* and *She lost her main transportation means* (517) would be translated as (518a) at the semantic level; (518b) shows the type-shifted version of the sentence's denotation; whereas the exhaustive interpretation wrt. the question *What happened?* is given in (518c). Notice that the latter does not imply in any fashion a coreference relation between the two eventualities e_1 (Alena's breaking of the skis) and e_2 (Alena's losing her main transportation means). In contrast, the corresponding restatement (519), where the exhaustification operator takes narrow scope over each sentence in accordance with (506a), does imply such a coreference relation—the properties *Alena broke her skis* and *She lost her main transportation means* apply to the same eventuality e , cf. (520).⁴¹ This distinction between (520) and (518c) is supposed to reflect the intuition that (519) suggests that skis were Alena's main transportation means, whereas (517) does not have this implication.

(516) What happened?

(517) Alena broke her skis (\nearrow)
and (she) lost her main transportation means (\searrow).

⁴⁰See Appendix A.2 for a proof.

⁴¹The exhaustive interpretation of (519) based on Groenendijk and Stokhof's original definition was derived in Section 5.3.3 cf. (439). The inference of (520) based on Bonomi and Casalegno's version is largely parallel to that of (473a), cf. Section 5.4 and Appendix A.4.7.

- (518) a. $\| \text{Alena broke her skis and she lost her main transportation means} \| =$
 $\lambda e \exists e_1 \exists e_2 [e = e_1 \oplus e_2 \wedge \| \text{Alena broke her skis} \| (e_1) \wedge \text{happen}(e_1) \wedge$
 $\| \text{she lost her main transportation means} \| (e_2) \wedge \text{happen}(e_2)]$
- b. $\text{EQS}(\| \text{Alena broke her skis and she lost her main transportation means} \|) =$
 $\lambda P \exists e_1 \exists e_2 [\| \text{Alena broke her skis} \| (e_1) \wedge \text{happen}(e_1) \wedge$
 $\| \text{she lost her main transportation means} \| (e_2) \wedge \text{happen}(e_2) \wedge P(e_1 \oplus e_2)]$
- c. $[\text{EX}_{\text{H}\&\text{C}}(\text{EQS}(\| \text{Alena broke her skis and she lost her main transportation means} \|))](\text{happen}) =$
 $\exists e_1 \exists e_2 [\| \text{Alena broke her skis} \| (e_1) \wedge$
 $\| \text{she lost her main transportation means} \| (e_2) \wedge$
 $\text{happen}(e_1 \oplus e_2) \wedge \forall e' [\text{happen}(e') \rightarrow [e' \leq e_1 \oplus e_2]]]$

- (519) Alena broke her skis (\searrow) .
 She lost her main transportation means (\searrow) .

- (520) $[\text{EX}_{\text{H}\&\text{C}}(\text{EQS}(\| \text{Alena broke her skis} \|))](\text{happen}) \wedge$
 $[\text{EX}_{\text{H}\&\text{C}}(\text{EQS}(\| \text{She lost her main transportation means} \|))](\text{happen}) =$
 $\exists e [\| \text{Alena broke her skis} \| (e) \wedge$
 $\| \text{She lost her main transportation means} \| (e) \wedge$
 $\text{happen}(e) \wedge \forall e' [\text{happen}(e') \rightarrow e' \leq e]]$

Finally, the subtle contrast in acceptability between (522a) and (522b) is explained in a similar way by the difference in the scope of the exhaustification operator (506a) vs. (506b), respectively. The asyndetically connected sentences in (522a) are interpreted according to scheme (506a), which ultimately leads to the entailment that the sentences describe a single event, cf. (523).⁴² However, as was pointed out before (cf. Section 5.3.3), this entailment is in conflict with the information that watching TV and studying normally cannot be the same activity, which leads to the slight infelicity of (522a). In contrast, (524), which represents the exhaustive interpretation of (522b) does not contain a requirement that these two activities be the same. Hence, the discourse is felicitous.

- (521) What did Kim do today?

- (522) a. ? Kim watched TV (\searrow) . She studied (\searrow) .
 b. Kim watched TV (\nearrow) , and (she) studied (\searrow) .

- (523) $\exists e [\| \text{Kim watched TV} \| (e) \wedge \| \text{She studied} \| (e) \wedge \text{do}(k, e) \wedge \text{today}(e) \wedge$
 $\forall e' [[\text{do}(k, e') \wedge \text{today}(e')] \rightarrow e' \leq e]]$

- (524) $\exists e_1 \exists e_2 [\| \text{Kim watched TV} \| (e_1) \wedge \text{do}(k, e_1) \wedge \text{today}(e_1) \wedge$
 $\| \text{She studied} \| (e_2) \wedge \text{do}(k, e_2) \wedge \text{today}(e_2) \wedge$
 $\forall e' [[\text{do}(k, e') \wedge \text{today}(e')] \rightarrow e' \leq e_1 \oplus e_2]]$

The analysis of the last two examples illustrates the most important features of the current proposal as compared to the previous approaches by Txurruka (2003) and Asher and Lascardes (2003). First of all, the semantic contrast between conjoined and asyndetically connected sentences is explained by a combination of two independently motivated mechanisms—the scope of exhaustifi-

⁴²The inference of the coreference requirement based on Groenendijk and Stokhof's original definition of exhaustification was discussed in Section 5.3.3, cf. (445). The inference of (523) based on Bonomi and Casalegno's version is largely parallel to that of (473a), cf. Section 5.4 and Appendix A.4.7.

cation which is restricted to a single utterance bearing a completion intonation, and the syntactic function of *and*, which makes a single sentence, and hence a single utterance, out of the clauses it connects. This allows us to maintain the standard semantics for *and*, ambiguous between the Boolean and the non-Boolean conjunction along the lines of Krifka (1990). By contrast, in order to achieve the same goal, Txurruka has to stipulate in the semantic rule for *and* a constraint on possible SDRT discourse relations, and hence semantic relations, that may hold between the sentences connected by *and*. In this respect, the proposed theory is more explanatory than that of Txurruka. Of course, the two proposals are not descriptively equivalent, and hence not truly comparable. In Txurruka's theory, the semantics of sentences with *and* is more restricted than that of the asyndetically connected sentences (Cf. Chapter 2, Section 2.3). The current proposal makes the interpretation of asyndetically connected sentences more restricted. I will not repeat the arguments in favour of the latter approach that were presented in Chapters 2 and 3. Nevertheless, it should be admitted that the proposed theory is too strong in that it basically allows for just one kind of semantic relation between asyndetically connected sentences—event coreference, or in SDRT terminology, the only discourse relations allowed are *Generalisation* and *Particularisation* in the sense of Danlos (1999). However, the examples discussed in Chapter 2 suggest that causal relations are possible, too. Some possible ways of weakening the proposed theory to cover these sorts of data will be discussed in Chapter 7.

The second point is related to the analysis of the example (522a). Recall that Asher and Lascarides (2003) explain the infelicity of this discourse by the impossibility of inferring any discourse relation between the sentences (cf. Chapter 2, pp. 66–67). According to Asher and Lascarides, the set of possible relations between the sentences *Kim watched TV* and *She studied* is too unrestricted. The hearer is provided with too little information to pick exactly one relation, the processing of the relation is suspended until further (disambiguating) input. But if no further input is provided, or if the provided input does not contain disambiguating information, the discourse relation remains unresolved and the sequence of sentences is infelicitous. However, this approach might run into difficulty explaining the felicity of (522b). The success of this approach would depend on the assumption that the conjunction *and* in (522b) disambiguates the discourse relation. This is a risky assumption given the weak semantics of conjunction *and*, as I argued in Chapter 2. The advantage of the approach developed in this chapter over Asher and Lascarides (2003) is that it does not need to rely on this assumption.

Thus I have shown that the semantic effects associated with the presence vs. absence of the conjunction *and* can be explained by its effect on the scope of exhaustification, and if the latter is defined after Groenendijk and Stokhof, the resulting meanings can be derived in a principled way and correspond to our intuitions. In the next section, I will consider the specific role of intonation in this process and concentrate in particular on minimal pairs that differ only in their prosodic realization—contrasts that were almost completely ignored in the formal discourse semantics.

5.5.2 Continuation intonation

In the examples analysed in the previous section, e.g. (526), absence vs. presence of a conjunction is not the only feature that distinguishes restatements (526a) from “lists” (526b). The second difference is in their prosody. Whereas the statements that constitute a restatement each bear a completion intonation (\searrow), the non-final elements of a list are uttered with a continuation intonation (\nearrow). In such examples, it is the segmentation of the discourse into utterances that seems to play the central role for exhaustive interpretation, intonation being no more than a reflex of this segmentation. That is, the completion tune marks the *end* of an utterance of type “statement” (as opposed e.g. to “question”), whereas the rise simply says “*This is not a complete utterance yet*”.

(525) Who snores?

- (526) a. A linguist (\searrow) . Mary (\searrow) .
b. A linguist (\nearrow) and Mary (\searrow) .

The purely structural role of continuation intonation is particularly evident in examples like (527) and (528). Here the semantic relation of the constituent that bears a rise (*a linguist* or *Kim watched TV*) to the rest of the sentence/utterance is determined by the syntactic and lexical composition of that sentence, and the continuation intonation only signals that the sentence is not complete. Similarly in (526b), the fact that *a linguist and Mary* represents a list (of two elements), is due to the semantics and the syntactic function of the conjunction *and*, rather than intonation.

- (527) a. A linguist (\nearrow) from Tübingen (\searrow) .
b. A linguist (\nearrow) that I met yesterday (\searrow) .

- (528) a. Before Kim watched TV (\nearrow) she studied (\searrow) .
b. Kim watched TV (\nearrow) only after she had studied (\searrow) .

If this were the only way in which continuation intonation is used then the present study would not have to be concerned with intonation at all. The scope of exhaustification and the related semantic effects discussed in the previous sections would be determined by the segmentation of discourse into well-formed syntactic constructions capable of an utterance status in the given context, which in turn is largely a matter of syntax and pragmatics. However, speakers also use continuation intonation to signal some sort of incompleteness even when they do not intend to complete the unit.⁴³ Thus an expression bearing a continuation rise may form an answer to a question all by itself, as in (530), which is both grammatical and understandable. Under one of the possible readings, (530) conveys the idea that Mary snores but perhaps there are other people who snore as well. However, if the choice of the rising tune were only licensed by non-final position in an utterance, (530) would be ill-formed.

(529) Who snores?

(530) Mary (\nearrow) ...

To account for examples like (530), I propose that the rising tune can optionally be attached at the end of a statement utterance, in which case it signals

⁴³See Chapter 3, pp. 92–96 for discussion.

that this statement should be interpreted *non-exhaustively*. That is, for instance, if the statement is constituted by a single NP and is used as an answer to a *wh*-question, the question predicate is combined with the literal semantic interpretation of the NP, without previously applying the exhaustification operator. The non-exhaustive interpretation of (530) is shown in (531): The generalised quantifier that corresponds to the meaning of *Mary* is applied to the question predicate *snore*, so the resulting proposition *snore(m)* only states that Mary is in the extension of *snore*, leaving open whether that set has other elements.

(531) $\| \text{Mary} \| (\text{snore}) = \text{snore}(m)$

Apparently, the same function of rising intonation is exploited in “open lists”, enumerations of objects (or eventualities) without an overt conjunction, such as (533). If we assume that the non-exhaustive interpretations of all utterances bearing rising tune in a sequence are logically conjoined (just as we assumed that the exhaustive interpretations of utterances bearing a fall are conjoined, cf. (506a) in Section 5.5.1), the interpretation of (533) as an answer to the question *Who snores?* is the proposition in (534). It states that Mary, John and Bill belong to the set of snorers, but says no more about the extension of the question predicate: maybe there are more people who snore, maybe not.

(532) Who snores?

(533) Mary (↗) , John (↗) , Bill (↗) , ...

(534) $\text{snore}(m) \wedge \text{snore}(j) \wedge \text{snore}(b)$

This analysis thus reflects the intuitively accessible difference in the meaning of “open lists” like (536b) and “closed lists” connected by a conjunction *and* and ending in an intonational fall, such as (536a), cf. (498). Moreover, it also guarantees that lists of either kind do not give rise to a coreference effect observed in sequences with repeating falling pattern, as in (526a). In (536a) this is so because exhaustification takes scope over the whole conjunction rather than each of the conjuncts individually, as explained in Section 5.5.1, whereas in (536b), the exhaustification operator does not apply at all. Finally, the same mechanisms are intended to “cancel” the coreference effect in (500), repeated in (538) below.

(535) Who snores?

(536) a. A linguist (↗) and Mary (↘) .

b. A linguist (↗) , Mary (↗) , ...

(537) What happened?

(538) a. Alena broke her skis (↗)

and she lost her main means of transportation (↘) .

b. Alena broke her skis (↗) ,

she lost her main means of transportation (↗) , ...

It should be noticed once again that according to this analysis, the rises (↗) in (536a) and (536b) are not used in the same function. In (536a), the continuation tune makes no contribution signals that the utterance is incomplete, like

in (527) and (528). In (536b), the continuation intonation is associated with a whole utterance and signals that it should be interpreted non-exhaustively. I.e. the proposed analysis makes (\nearrow) ambiguous. Of course, a solution that associates an expressive device with an invariant function is always more appealing. However as I pointed out in Chapter 3, pp. 136–137, in the case of (\nearrow) in discourses like (536a) and (536b) it is not immediately clear that we have to do with the same expressive device, i.e. the bundles of prosodic features in (536a) and (536b) both abbreviated by a rising arrow may in fact be phonologically distinct. In (536b), a longer pause after *linguist* and perhaps a greater amount of phrase-final lengthening appears more likely than in (536a). Moreover, the two kinds of incompleteness may also be signalled by melodic distinctions. For instance in the Russian version of (536a), a rise-fall tune ([LH]* L-) or a rising accent with a subsequent high plateau ([LH]* H-) would be more likely, whereas a rise with a plateau declining to mid-level ([LH]* !H-) is more typical of open lists. In this study, I do not pursue the goal of teasing apart the individual contributions of each relevant prosodic feature, which is a task for future research. The only distinction that I will make is that between completion falls and continuation rises as defined in Chapter 3. Given this limitation, the continuation rise has to be associated with more than one function.

The present proposal provides a natural explanation for the contrasts between (540a) and (540b), i.e. the fact that replacing the completion intonation by continuation intonation alone can make (540a) felicitous. Obviously, since exhaustification does not take place in (540b), it does not give rise to a coreference effect, cf. (541), and hence the conflict with world knowledge, also discussed in connection with example (522) in Section 5.5.1, does not arise.

(539) What did Kim do today?

(540) a. ? Kim watched TV (\searrow) . She studied (\searrow) .
 b. Kim watched TV (\nearrow) , she studied (\nearrow) , ...

(541) $\exists e_1[||\text{Kim watched TV}|| (e_1) \wedge do(k, e_1) \wedge today(e_1)] \wedge$
 $\exists e_2[||\text{She studied}|| (e_2) \wedge do(k, e_2) \wedge today(e_2)]$

Such effects of intonation did not receive any consideration in Asher and Lascarides' (2003) treatment of (540a) and are not easy to integrate in their proposal. As repeatedly mentioned before, Asher and Lascarides (2003) attribute the infelicity of (540a) to the impossibility of deciding on exactly one discourse relation without further disambiguating information. However, in order to explain the felicity of (540b) in this type of approach, one would be forced to claim that completion intonation provides such disambiguating information. This would be even less plausible than attributing a disambiguating function to the conjunction *and*. If in the case of *and* one could still follow Txurruka (2003) and claim that the conjunction indeed constrains the set of possible discourse relations between the utterances it connects (cf. Section 2.3.1 in Chapter 2), using the same strategy in the case of list intonation would be undesirable. For one thing, it would fail to account for examples like (530) where the notion of discourse relation seems to be irrelevant. There is nothing the utterance could be related to, nevertheless (530) is acceptable and the continuation intonation makes a clearly identifiable contribution to its interpretation.

Thus my claim is that intonational meaning is not relational in the sense that

it directly influences the choice of a discourse relation between two utterances. Wherever this seems to be the case, the intonation in fact only modifies the meaning of the utterance on which it is realised, and the relational effects arise as a consequence of simply conjoining these modified meanings.

This view is also corroborated by data like (505), repeated in (543). As I argued in Chapter 3, pp. 103–103, the choice between completion and continuation intonation on the second sentence influences the interpretation and the felicity of the discourse. If both sentences bear a completion fall, the discourse is not optimal (543a), if it is to be interpreted at all, the event of plan drawing would either be understood as evidence for, cause of, or all the relevant content of building the bridge. Against the background of world knowledge, all three possibilities are rather unlikely.⁴⁴ By contrast, (543b) is felicitous and suggests that drawing plans was a (proper) part (a preparatory phase) of building the bridge.

(542) What’s new in town?

- (543) a. # The council built the bridge (↘) .
 The architect drew up the plans (↘) .
 b. The council built the bridge (↘) .
 The architect drew up the plans (↗) ...

These contrasts can be accounted for in the proposed theory. The discourse in (543a) can be analysed along the same lines as that in (540a). The exhaustive interpretation leads to the event coreference effect, which contradicts the world knowledge. The situation is different in (543b). Here, only the first sentence *The council built the bridge* is interpreted exhaustively, as shown in (544). (The predicate *new* stands for the question predicate of *What’s new in town?*) The second sentence *The architect drew up the plans* receives a normal, non-exhaustive interpretation since it ends in a continuation rise, cf. (545).

(544) $\exists e_1[||\text{The council built the bridge}||_e(e_1) \wedge \text{new}(e_1) \wedge \forall e[\text{new}(e) \rightarrow e \leq e_1]]$

(545) $\exists e_2[||\text{The architect drew up the plans}||_e(e_2) \wedge \text{new}(e_2)]$

(546) $\exists e_1 \exists e_2[||\text{The council built the bridge}||_e(e_1) \wedge \text{new}(e_1) \wedge$
 $||\text{The architect drew up the plans}||_e(e_2) \wedge \text{new}(e_2) \wedge e_2 \leq e_1 \wedge$
 $\forall e[\text{new}(e) \rightarrow e \leq e_1]]$

It is quite obvious that it follows from the conjunction of (544) and (545) that the event of drawing plans must be part of the event of bridge building, cf. $e_2 \leq e_1$ in (546). However, the opposite $e_1 \leq e_2$ does not necessarily hold (note that it would hold if the second sentence were also interpreted exhaustively), hence there is no coreference requirement ($e_1 = e_2$) and no contradiction with world knowledge. In other words, (546) is compatible with the proper part relationship between e_2 and e_1 ($e_2 < e_1$). To put the same derivation in more intuitive terms, the exhaustive interpretation of *The council built the bridge* (licensed by the falling intonation) says that the building the bridge by the council is the only event that satisfies the question predicate “new in town”—the council built the bridge and that’s all the news. That is, whatever is new in

⁴⁴Recall that we always assume that the felicity judgement refers to the discourse as it is given in the examples, i.e. without any continuation, supposing the discourse (dialogue) could end just there.

town must be part of that bridge building event. Hence, the architect’s drawing up of the plans must be part of it. However, since the sentence *The architect drew up the plans* is interpreted non-exhaustively due to the rising intonation, there is no requirement associated with it that whatever is new be part of drawing up the plans, and hence building the bridge by the council need not be part of that event. Therefore the two events need not corefer, and the event of drawing up the plans may be a proper part of the event of bridge building. This correctly reflects the intuitions about the interpretive differences between (543a) and (543b).

Thus (543) is another example that shows how intonation alone may influence the choice of a semantic relation between two sentences without “denoting” any relational constraints. Thus the standard view that falling intonation signals “completion” and rising intonation signals “continuation” can be maintained, whereas the relational impact of intonation can be derived as epiphenomenal. Again, data like (543) are not considered by Asher and Lascarides (2003) and present a challenge to their approach.

To conclude this section it should be admitted that the proposed analysis “as is” also has problems. For instance, it seems to make incorrect predictions for non-canonical combinations of a conjunction with an intonational pattern, e.g. if rising intonation is used but no conjunction appears (548); or if falling intonation is used and there is a “hanging” *and* conjunction (549).

(547) What was Alena doing?

(548) ? Alena was cooking raspberry jam (↗) ,
she was fulfilling Marina’s assignment (↘) .

(549) Alena was cooking raspberry jam (↘) .
And she was fulfilling Marina’s assignment (↘) .

In the first case, the proposed theory would predict that one of the possible interpretations of (548), is that Alena’s cooking jam is part of her fulfilling Marina’s assignment, i.e. the example is analysed along the same lines as (543b), with the only difference that the order of the fall and the rise is reversed. However, whether this reading is actually available seems to depend on additional prosodic characteristics associated with the rise. If (548) is uttered with a very short or no pause after the first sentence, if the prosodic unit corresponding to the first sentence exhibits a relatively little amount of final lengthening, and if the melodic properties of the rise are those typical for “sentence-internal” rises (e.g. [LH]* H- in Russian, cf. Chapter 3, pp. 136–137), then (548) seems somewhat suboptimal, and if it is to be interpreted at all then as a restatement rather than a list of actions, or as one event being a proper part of the other. By contrast, if the first sentence is followed by a long pause (indicated by “...” in (550)), is realised with a greater amount of final lengthening and bears an “open list” rise ([LH]* !H- in Russian), then the part-whole reading seems appropriate, i.e. (550) suggests that Marina’s assignment for Alena included, perhaps, more than just cooking raspberry jam, but cooking raspberry jam was at least part of it.

(550) Alena was cooking raspberry jam (↗) ...
She was fulfilling Marina’s assignment (↘) .

These observations suggest that an improved version of the proposed theory should indeed make a systematic distinction between “(↗),” and “(↗) ...”. The bundle of prosodic features here abbreviated as “(↗) ...” should indicate the end of a sentence/utterance and the instruction to interpret it non-exhaustively; “(↗),” should indicate that the expression is not a complete sentence/utterance yet and should be “kept open” for further syntactic attachment. This would perhaps explain the somewhat suboptimal character of (548): on the one hand, the speaker instructs the hearer to keep the expression *Alena was cooking raspberry jam* open for syntactic attachment, on the other hand, (s)he does not provide any syntactic means (e.g. a conjunction) to attach the subsequent expression *she was fulfilling Marina’s assignment*. Thus the sequence is reinterpreted as two utterances, and further interpretation follows the same principles as in usual restatements.⁴⁵

As far as discourses with “hanging” conjunctions like (549) are concerned, the first question is what kind of semantics should be assigned to a sentence with a hanging conjunction such as *And (she was) fulfilling Marina’s assignment*. According to the analysis proposed in Section 5.5.1, the conjunction *and* denotes a two-place relation. This means that in *And (she was) fulfilling Marina’s assignment*, the first argument of *and* is missing, so the sentence does not denote a proposition (or an event property) and hence does not have the appropriate semantic type to be input to the exhaustification operator (via EQS), cf. Section 5.3.2. In other words, the theory predicts that (549) is semantically ill-formed. But obviously, (549) is not as bad as that, and seems to allow for both a list and a restatement reading. One possible way out could be to say that even after an intonational fall the preceding constituent can optionally be kept open for syntactic attachment, so that after all, it forms a sentence together with the subsequent hanging conjunct.

I will not develop these adjustments any further in this study. Both of them operate with concepts of sentence processing—attachment, as a step in parsing; reinterpretation etc.—i.e. can only be realised in a framework that formalises those concepts. Embedding the current proposal in such a framework

⁴⁵In consequence, if the grammar of a language allows assignment of a syntactic structure to a sequence of asyndetically connected clauses, then that structure and the corresponding semantic reading should be preferred in examples like (548), i.e. in cases where the first clause bears a “(↗),” and the second a normal completion intonation. Indeed, this appears to be the case, for instance in Russian, where asyndetically connected clauses can be analysed as a conditional statement (cf. also V1-conditionals in German). If the first clause is realized with a “(↗),” then the conditional interpretation is strongly preferred, cf. (i) and (ii), adapted from Bryzgunova (1982, p. 652):

- (i) Dosidela by do konca (↗),
 Sit SUBJUNCTIVE till end
 on by tebja i do domu (↘) dovel .
 he SUBJUNCTIVE you also till home accompany
*If you had (“had you”) stayed until the end,
 he would have also accompanied you home.*
- (ii) Dosidela by do konca (↘),
 Sit SUBJUNCTIVE till end
 on by tebja i do domu (↘) dovel .
 he SUBJUNCTIVE you also till home accompany
*You should have stayed until the end.
 He would have also accompanied you home.*

goes beyond the scope of this dissertation, although some relevant ideas will be discussed in Chapter 7.

5.6 Discussion

In this chapter, I developed a theory of restatement based on the formalisation of the notion of exhaustivity proposed by Groenendijk and Stokhof (1984) and its modification by Bonomi and Casalegno (1993). The informal ideas presented in Chapter 4 could be put to work using that formalisation. The central idea that was realised here is that the coreference relations that hold in restatements are a consequence of the exhaustive interpretation of two utterances as answers to the same question. It was shown that many cases of coreference can be accounted for in this way: coreference of NPs in nominal restatements, event coreference in restatements in the usual sense (sentential restatements). Even (proper) part-whole relations between events in elaborations of certain types could be captured.

As I argued in Chapter 4, the incoherence of some discourses which was previously attributed to their “underinformativeness” as far as the choice of a discourse relation is concerned (Asher and Lascarides, 2003) can instead be captured in terms of a contradiction between world knowledge and the coreference effect induced by exhaustification. In this chapter I demonstrated the formal derivation of such a contradiction.

Furthermore, it was shown how the presence of the conjunction *and*, as well as continuation intonation interfere with the process of exhaustification and the inference of coreference associated with it. As far as the conjunction is concerned, I did not need to assume more than the standard semantics of natural language conjunction (Krifka, 1990) in order to derive the observed effects. Thus the proposed analysis presents a both formally tractable and explanatively appealing alternative to the proposal of Txurruka (2003)—the only formal account of this phenomenon so far. As for the opposition of continuation and completion tunes, its influence on the semantic relations in discourse used to be completely ignored in previous formal theories of such relations. Thus the analysis proposed in this chapter is the first to approach this group of data.

In terms of empirical data coverage, the proposed theory has both advantages and drawbacks in comparison to previous proposals in the framework of SDRT. The advantages include (in addition to the coverage of intonation mentioned above): (a) the inference of event coreference in the absence of lexical cues such as hyponymy/hyperonymy relations, cf. Danlos (1999); and (b) a weaker semantics for conjoined clauses than that proposed by Txurruka (2003), i.e. for instance, causal relations between conjoined clauses as in (551) are allowed, whereas they are excluded by Txurruka’s theory.

(551) Max fell and it was John who pushed him.

The main disadvantage of the proposed theory is that it is too strong as far as the inference of event coreference is concerned. Basically, it predicts that restatement (event coreference) is the only discourse relation possible between two sentences that both end in a completion intonation and are not connected by a conjunction. In particular, it erroneously excludes the possibility of a causal relation between distinct pushing and falling events in examples like (552).

(552) Max fell. John pushed him.

Some possible ways of weakening the current theory in order to capture data like (552) will be discussed in Chapter 7. At this point, I would like to concentrate on a different group of problems, related specifically to Groenendijk and Stokhof's formalisation of exhaustivity.

It is well known that, leaving restatements aside, Groenendijk and Stokhof's theory has a number of problems in connection with its primary empirical domain—exhaustive interpretation of single answers. One of these problems was already discussed at length in this chapter, namely exhaustification in structured domains (cf. Section 5.4). We used one of the modifications of Groenendijk and Stokhof's theory discussed by Bonomi and Casalegno (1993) as a temporary solution to this problem, in order to proceed with the investigation of restatements and demonstrate the role of exhaustification in restatements involving complex individuals and events. However, this solution was indeed only satisfactory for demonstration purposes. In general, it has a number of serious limitations. One problem, also pointed out by Bonomi and Casalegno (1993, pp. 7–8), is the incorrect exhaustification of distributive universal quantificational NPs such as *every linguist*: $\text{EXH}_{B\&C}(\|\text{every linguist}\|)$ entails that there exists exactly one linguist (see Appendix A.4.6 for a complete derivation), which is obviously the wrong result. Moreover, this problem is in fact much more general since it concerns all sorts of distributive readings of NPs, not just universals. For instance, the exhaustification of the distributive reading of *John and Mary* ($\lambda P[P(j) \wedge P(m)]$) leads to the absurd entailment that John and Mary are the same individual (cf. Appendix A.4.6). In other words, the approach is generally limited to collective (readings of) NPs.

This limitation has far-reaching consequences. First of all, even though it is sufficient for question predicates that are distributive in the summative sense as well as for various sorts of summative and divisive predicates, this approach is incompatible with the atomic notion of distributivity, since the latter requires distributive NP readings. Recall that in order to use Bonomi and Casalegno's definition with restatements that answer the question *Who snores?*, we were forced to assume that the predicate *snores* is summatively distributive, i.e. contains both individual snorers as well as groups of snorers, whereas a more standard approach would rather assign it an atomic denotation (e.g. Link, 1983). Second, the limitation to collective NP readings does not allow us to capture the exhaustivized distributive readings of NPs that answer questions with a non-distributive question predicate. For example, the answer *John and Mary* to the question *Who can lift a piano?* will never receive an exhaustive interpretation saying that John can lift a piano, and Mary can lift a piano (Mary being an individual distinct from John), but no one else can lift a piano, although this interpretation seems intuitively available.

Moreover, neither Groenendijk and Stokhof's original definition of exhaustification nor its modification by Bonomi and Casalegno respect relations other than part-whole relations between the individuals in the structured domain. For instance, consider the question-answer pair in (553)–(554). Suppose we follow the standard view (Link, 1983) and assume that a golden ring and the gold that makes up that ring are two distinct individuals. (This view is motivated by the fact that different sets of predicates may apply to these objects: for instance, while the ring may be new, the gold that it is made of may be old.) These two

objects are connected by a “materialisation” relation ‘ \triangleright ’ that expresses the idea that the gold “constitutes” the ring (*gold* \triangleright *ring*); however, according to Link’s proposal, \triangleright is distinct both from equivalence and from a part-whole relation \leq . This means, however, that the exhaustive interpretation of *a golden ring* (554) with respect to the question predicate *in the box* (553) would entail that only the ring is in the box, but not the gold that constitutes it. Both Groenendijk and Stokhof’s and Bonomi and Casalegno’s definitions of the exhaustification operator would lead to this absurd result.

(553) What is in the box?

(554) A golden ring.

Thus the problem of exhaustification in structured domains is still largely unsolved, and calls for a general treatment compatible with the standard views on the semantics of plurals, mass terms, distributivity, as well as other meaning postulates that may appear useful. Without such a solution, the usefulness of the proposed theory of restatements is limited.

There is also a second group of problems related specifically to Groenendijk and Stokhof’s (as well as Bonomi and Casalegno’s) formalisation of exhaustivity. This group includes various problems that have to do with the influence of the context and the speakers’ communicative goals on the interpretation of answers to questions. These issues have not been discussed so far, since they do not seem to play a major role in the proposed analysis of restatements, at least in the analyses of the simple cases presented in this chapter. However, these problems will also turn out relevant in the long run (see Chapter 7), and since they have been the object of particularly sharp criticism in the literature, I will briefly recapitulate the related discussion here.

The main thesis put forward by Groenendijk and Stokhof’s opponents, e.g. Ginzburg (1995), is that a satisfactory (*resolving*) answer to a question is not necessarily exhaustive. Moreover, whether an answer is resolving or not depends only partly on its semantic content. For the other part, it depends on the context and the communication situation.

First of all, the context constrains the quantification domain of exhaustification. For instance in (555), the answer *John and Mary* need not mean that John and Mary are the only individuals in the world that attended the meeting. For instance, if the querier is John’s and Mary’s boss, then the interpretation of (555b) that first comes to mind is that John and Mary are the only employees in his or her department that attended the meeting. Thus the answer is resolving (the querier has found out who attended the meeting), but not exhaustive in the sense of Groenendijk and Stokhof’s definition.

(555) a. Who attended the meeting?

b. John and Mary.

The second problem has become known as the problem of *granularity*. Apparently, different communicative situations require answers that are differently fine-grained. For instance, if the utterer of (556a) is, let’s say, in Berlin, and is calling the utterer of (556b) on the cell phone to find out why she could not reach her at home, then the answer *in Helsinki* (and nowhere else) seems perfectly complete and exhaustive. However, if the querier is in Helsinki herself, and calls the utterer of (556b) in order to figure out a place to meet, then (556b) only

provides a partial answer to (556a), as it constrains the set of possible locations of the second speaker, but does not specify *the one* relevant location given the required degree of granularity. In other words, one and the same answer may be complete (exhaustive), or incomplete, depending of the communicative goals of the conversants.

- (556) a. Where are you?
b. In Helsinki.

The third group of problematic data present so-called *mention-some* answers. For example, if a stranger in the street asks you where they can buy an Italian newspaper, it is likely that they will be satisfied if you name just one such place rather than the complete list of places selling Italian newspapers in town, cf. (557). Therefore, there is no exhaustivity implicature whatsoever associated with the answer, and the querier is aware that “the station” might not be the only place.

- (557) a. Where can I buy an Italian newspaper?
b. At the station.

Data of this sort led Ginzburg (1995) to drop the notion of exhaustivity as a necessary feature of an answer, and replace it with context-sensitive resolvedness.⁴⁶ But if the relevance of exhaustivity in a pragmatic theory of answers is as limited as Ginzburg’s argumentation suggests, then one should ask what consequences this has for the theory of restatements developed in this chapter, in which exhaustivity plays the most central role.

To sum up, two classes of problems—exhaustification in structured domains and the context-sensitive character of the pragmatics of answers—constitute a major challenge for Groenendijk and Stokhof’s theory, as well as any theory that builds on it. However, in a number of recent studies, van Rooij and Schulz (van Rooij, 2003a; van Rooij and Schulz, 2004a,b) have developed an approach that, on the one hand, provides a solution to both types of difficulties, and on the other hand, preserves the main ideas and predictions of Groenendijk and Stokhof (1984). Instead of dropping the idea of exhaustification altogether, it is made sensitive to both lexical information (meaning postulates in structured domains) and the communicative goals of discourse participants. Therefore, in the next chapter, the current theory of restatements will be recast in terms of van Rooij and Schulz’ proposal.

⁴⁶The examples are presented in adapted form, rather than in Ginzburg’s exact formulation.

Chapter 6

Formal Analysis II: Van Rooij and Schulz

In the previous chapter I developed a theory of restatement based on Groenendijk and Stokhof's (1984) notion of exhaustification. In this chapter the proposed theory should be recast in terms of the approach to exhaustive interpretation developed by van Rooij (2003a) and van Rooij and Schulz (2004b). A few considerations motivate this move. First of all, while preserving most "good" features of Groenendijk and Stokhof's proposal, van Rooij and Schulz provide (more elegant) solutions to a number of empirical problem it faces. For instance, the problem of meaning postulates in structured domains receives a solution that is largely independent of the details of the semantic analysis of plurals, mass terms and distributivity. Furthermore, exhaustive interpretation is made sensitive to an independently motivated notion of *relevance*, which solves the problems of domain restriction, granularity, and mention-some answers.¹

Second of all, van Rooij and Schulz' goal is not only to give a formal description of the data, but also to link this description to the Gricean principles of communication. In other words, van Rooij and Schulz' theory of exhaustive interpretation is intended as a formalisation of Grice. Thus implementing the present analysis of restatement (and other discourse relations) within this framework will allow us to link the process of discourse interpretation to Gricean pragmatics. The aim of reanalysing discourse relations as a consequence of Gricean reasoning has been pursued by whole trends in linguistic research, one of the most prominent being Relevance Theory. However, so far these ideas lacked appropriate formalisation. Relating the proposed analysis of restatement to the essentially Gricean notion of exhaustivity as it is conceived by van Rooij and Schulz (2004b) is a step in the direction of providing such a formalisation.

The necessary elements of van Rooij and Schulz' theory will be presented in a step by step fashion. First, I will introduce their most basic definition of exhaustification which does not yet take relevance and related context effects into account, but already provides a general solution to the meaning postulates problem, which is the main topic of Section 6.1. Next, we will regard exhaustifi-

¹Only the solution to the domain restriction problem will be discussed in detail in this chapter. Mention-some answers will be touched upon briefly in Section 6.7.1 and granularity is not discussed at all.

cation as a variety of *dynamic* interpretation function operating on information states as sets of worlds. Since the outcome of dynamic interpretation crucially depends on the information state, which includes information accumulated in the common ground of the discourse participants, I will first consider the interpretation of restatements in *minimal* information states, i.e. states of the common ground where no information is contained yet (Section 6.2). Then in Section 6.3, I will discuss some problems related to accumulating information in the common ground. These problems will motivate a modification of van Rooij and Schulz’ original definition, which will make exhaustification somewhat less sensitive to the accumulated information. In Section 6.4, I will show that the data coverage lost by this modification can be regained by making exhaustification sensitive to *relevance*. After a short interim summary in Section 6.5, this proposal will be applied to sentential restatements involving *Elaboration* (Section 6.6). That will constitute the central building block of a more general theory of discourse relations outlined in Chapter 7. Finally, Section 6.7 will present some brief remarks on problematic issues pertaining specifically to nominal restatements and lists, which were discussed in the previous chapters but will not be taken up in Chapter 7.

6.1 The basic setting

In this section I outline the basics of van Rooij and Schulz’ theory of exhaustive interpretation. One goal is to show how it is applied technically, the other one is to demonstrate van Rooij and Schulz’ solution to the problem of exhaustification in structured domains and the meaning postulates, extensively discussed in Sections 5.4 and 5.6 of the last chapter. Recall that this problem is one of the main hurdles for a plausible analysis of answers to *What happened?* questions and sentential restatements, and that the temporary solution used in the previous chapter was not satisfactory for various reasons. Nevertheless, the difference between van Rooij and Schulz basic definition of exhaustification and Groenendijk and Stokhof’s is indeed a minor one, and as van Rooij and Schulz themselves claim, the approaches are almost equivalent. All van Rooij and Schulz do is reformulate Groenendijk and Stokhof’s definition using the idea of *predicate circumscription* that comes from the work in artificial intelligence (McCarthy, 1980, 1986). Yet this change makes van Rooij and Schulz’ exhaustification sensitive to the structure of the model in a non-trivial way and provides a rather general solution to the problem of meaning postulates.

Recall that according to Groenendijk and Stokhof, the exhaustive interpretation of an answer Q (a generalised quantifier) to the question *Who P?* is true whenever the extension of P is *minimal*, i.e. there is no “smaller” P' in Q , cf. (558).² If we give it a more intensional turn, the exhaustive interpretation of the answer can be identified with the set of worlds where the set denoted by the question predicate P is minimal among the possibilities provided by the quantifier Q of the answer (559).

$$(558) [\text{EXH}(Q)](P) \text{ iff } Q(P) \wedge \neg \exists P' [Q(P') \wedge P' \subset P]$$

$$(559) [\text{EXH}(Q)](P) = \{w \mid Q(w)(P) \wedge \neg \exists P' [Q(w)(P') \wedge P'(w) \subset P(w)]\}$$

²See also Section 5.1.

Van Rooij and Schulz' basic definition of exhaustification is similar to (559). However, instead of selecting the minimal set in the extension of a quantifier in a particular world and then identifying it with the question predicate, exhaustification directly selects worlds with the minimal extension of the question predicate. This might seem a mere word game at first glance, but in fact this minor change has far-reaching consequences.

When we minimise a quantifier along the lines of Groenendijk and Stokhof, we may end up with a set that is not among the possible extensions of the question predicate due to the meaning postulates associated with that predicate. For instance, if we apply Groenendijk and Stokhof's exhaustification operator to (the collective reading of) the quantifier *John and Mary* (560), the resulting quantifier will only contain the singleton set $\{j \oplus m\}$, since it is smaller than all the other candidates, e.g. $\{j \oplus m\} \subset \{j \oplus m, j, m\}$. However, if the question predicate P happens to be, for instance, summatively distributive, $\{j \oplus m\}$ is not among its possible extensions, and $[\text{EXH}(\lambda P[P(j \oplus m)])](P)$ is always false. In other words, the problem is that EXH does not pay attention to the possible extensions the question predicate may have.

$$(560) \lambda P[P(j \oplus m)] = \{\{j \oplus m\}, \{j \oplus m, j\}, \{j \oplus m, m\}, \{j \oplus m, b\}, \{j \oplus m, j, m\}, \dots\}$$

$$(561) \text{EXH}(\lambda P[P(j \oplus m)]) = \{\{j \oplus m\}\}$$

By contrast, if exhaustification selects worlds with the minimal extension of P among the worlds that are actually available in the model, and if meaning postulates are viewed as constraints on that model, i.e. worlds that do not conform to the meaning postulates are simply not considered, then the outcome of exhaustification will never be inconsistent with the meaning postulates. Van Rooij and Schulz guarantee this by means of the following definition:

$$(562) \text{exh}^W(A, P) = \{w \in [A]^W \mid \neg \exists v \in [A]^W [v <_P w]\}$$

According to this definition, the exhaustive interpretation of proposition A (the answer) with respect to the question predicate P in a set of worlds W is a set that only contains those worlds from the normal interpretation of A in W ($[A]^W$) that are *minimal* with respect to a relation $<_P$. The relation $<_P$ orders worlds along the inclusion relation between the extensions of the predicate P in those worlds, that is, if $v <_P w$ then $F(P)(v) \subset F(P)(w)$.³ In this way exhaustive interpretation selects worlds in which the extension of P is smallest. An example of how this definition works with various meaning postulates will be discussed presently, but first a few more words should be said about the definition of $<_P$.

Van Rooij and Schulz impose an additional requirement on worlds that stand in the $<_P$ relation: apart from the extension of P , these worlds should be alike, cf. (563). That is, if $w_1 <_P w_2$ the interpretations of expressions other than P should be identical in w_1 and w_2 . The *ceteris paribus* condition in the definition of $<_P$ is essential for the correct exhaustive interpretations of universal quantifiers, e.g. *Who snores? Every linguist (snores)*. It is also indispensable for the correct account of conditional answers in dialogues like *Will Mary win? Yes, if John doesn't realise that she is bluffing*.

³ F is an interpretation function that assigns sets of tuples of objects to predicate symbols and λ -terms relative to a world.

(563) $w_1 <_P w_2$ iff world w_1 is just like w_2 except that $F(P)(w_1) \subset F(P)(w_2)$.

However, the *ceteris paribus* condition is notoriously difficult to define in a plausible and uncontroversial way. Clearly, it cannot be the case that literally *all* expressions except P have equal extensions in two worlds whereas the extensions of P are unequal. Take for instance $\lambda x[\neg P(x)]$. With the standard semantics for negation, the extension of $\lambda x[\neg P(x)]$ in each world is the complement of the extension of P in that world. Hence whenever $F(P)(w_1) \subset F(P)(w_2)$, $F(\lambda x[\neg P(x)])(w_2) \subset F(\lambda x[\neg P(x)])(w_1)$, i.e. no two worlds have equal extensions of $\lambda x[\neg P(x)]$ if their extensions of P are unequal. Thus the $<_P$ ordering collapses altogether, and no worlds will be comparable according to $<_P$.

To avoid this, the set of expressions \mathcal{X} that are taken into account by the *ceteris paribus* condition should be restricted, cf. (564). At the very least, \mathcal{X} should be restricted to the expressions that are syntactically independent of P . For instance, one could require that \mathcal{X} be composed solely of elementary predicates (rather than λ -terms), and in case P is itself a complex λ -term, elementary predicates occurring in P should be excluded from \mathcal{X} .⁴

(564) $w_1 <_P w_2$ iff
 a. $F(P)(w_1) \subset F(P)(w_2)$, and
 b. for all $R \in \mathcal{X}$, $F(R)(w_1) = F(R)(w_2)$.

Apart from these constraints, I would like to remain silent on the exact contents of \mathcal{X} .⁵ In the examples discussed in this chapter, it will be assumed that all elementary predicates in the example (and syntactically independent of P) are in \mathcal{X} , i.e. are taken into account for *ceteris paribus*. Of course, in a “real world” situation, if \mathcal{X} is not sufficiently restricted it may contain expressions that are semantically (though not syntactically) dependent on the question predicate, e.g. *man* and *woman*, or *man* and *bachelor*. Such semantic non-independence may lead to similar problems as those mentioned above. However, this will not be an issue in the examples discussed in this chapter.

Let’s consider some examples. We will first look at example (565)–(566) again, but assume for a change that *snore* is distributive in the atomic sense, i.e. only the atomic (singular) individuals are allowed in the extension of *snore*, rather than groups of individuals, cf. (567). Obviously, the collective reading of *John and Mary*— $\lambda P[P(j \oplus m)]$ —will always lead to a false sentence in combination with the atomically distributive *snore*, hence we will only consider the distributive reading of the NP, $\lambda P[P(j) \wedge P(m)]$. Thus the logical form of (566) is simply $snore(j) \wedge snore(m)$.

(565) Who snores?

(566) John and Mary (snore).

(567) $\forall x[snore(x) \rightarrow Atom(x)]$

Suppose our domain of individuals contains three atomic objects *John*, *Mary* and *Bill*, and groups thereof, i.e. $D = \{j, m, b, j \oplus m, j \oplus b, m \oplus b, j \oplus m \oplus b\}$. With such a domain and the meaning postulate in (567), the predicate

⁴This corresponds to the general form of circumscription discussed by Hamm (2000, pp. 196–198).

⁵In one of their definitions, van Rooij and Schulz use the set of elementary expressions occurring in the answer A as a further constraint on \mathcal{X} (van Rooij and Schulz, 2004b, p. 30).

<i>snore</i> \mapsto							
$\{j, m, b\}$	$\{j, m\}$	$\{j, b\}$	$\{m, b\}$	$\{j\}$	$\{m\}$	$\{b\}$	\emptyset
(w_1)	(w_2)	w_3	w_4	w_5	w_6	w_7	w_8

Table 6.1: The interpretation function F maps predicate *snore* to set $\{j, m, b\}$ in world w_1 , to set $\{j, m\}$ in world w_2 , and so on. The dashed ovals highlight the worlds that belong to the normal, non-exhaustive interpretation of *John and Mary snore*. The world in the solid line oval constitutes the exhaustive interpretation of *John and Mary snore* with respect to the question predicate *snore*.

snore has eight possible extensions that correspond to all subsets of the atomic part of D : $\{j, m, b\}$, $\{j, m\}$, $\{j, b\}$, $\{m, b\}$, $\{j\}$, $\{m\}$, $\{b\}$ and \emptyset . Further, suppose that exactly one world corresponds to each of these possibilities ($W = \{w_1, w_2, w_3, w_4, w_5, w_6, w_7, w_8\}$), that is for instance, in w_1 the extension of the predicate *snore* is $\{j, m, b\}$: $F(\textit{snore})(w_1) = \{j, m, b\}$. Interpretations of *snore* in all the worlds are shown schematically in Table 6.1.

In order to compute the exhaustive interpretation of the answer (568), one first has to find the set of worlds that corresponds to its literal meaning $[\textit{snore}(j) \wedge \textit{snore}(m)]^W$, all those worlds in which the proposition $\textit{snore}(j) \wedge \textit{snore}(m)$ is true. Notice that van Rooij and Schulz' exhaustification takes the proposition as its first argument, i.e. the logical form of the sentence *John and Mary snore*, where the elided verb has been recovered (unlike Groenendijk and Stokhof's EXH, which takes an NP as input). Obviously, both John and Mary belong to the set of snorers in two worlds: w_1 and w_2 (highlighted with dashed ovals in Table 6.1). Thus, $[\textit{snore}(j) \wedge \textit{snore}(m)]^W = \{w_1, w_2\}$.

$$(568) \textit{exh}^W(\textit{snore}(j) \wedge \textit{snore}(m), \textit{snore}) = \{w \in [\textit{snore}(j) \wedge \textit{snore}(m)]^W \mid \neg \exists v \in [\textit{snore}(j) \wedge \textit{snore}(m)]^W [v <_{\textit{snore}} w]\}$$

Next, we need to find the minimal worlds wrt. the $<_{\textit{snore}}$ relation. The complete ordering of W by $<_{\textit{snore}}$ is represented graphically in Figure 6.1, but we are only interested in the worlds in $[\textit{snore}(j) \wedge \textit{snore}(m)]^W$. Clearly, among w_1 and w_2 , w_2 is the smaller one: $F(\textit{snore})(w_2) = \{j, m\}$, whereas $F(\textit{snore})(w_1) = \{j, m, b\}$. Hence $F(\textit{snore})(w_2) \subset F(\textit{snore})(w_1)$, i.e. according to (564), $w_2 <_{\textit{snore}} w_1$. Thus the exhaustive interpretation of $\textit{snore}(j) \wedge \textit{snore}(m)$ in the given model W contains just one world w_2 . In that world, John and Mary snore and nobody else snores, which is the expected exhaustive meaning of the answer *John and Mary* to the question *Who snores?*

$$(569) \textit{exh}^W(\textit{snore}(j) \wedge \textit{snore}(m), \textit{snore}) = \{w_2\}$$

This was just a brief illustration of how this approach works technically. For this simple example it produces the same result as any other theory of exhaustification. Let's next consider a more complex case, where multiple meaning postulates are involved, more tricky ones than atomic distributivity. For instance,

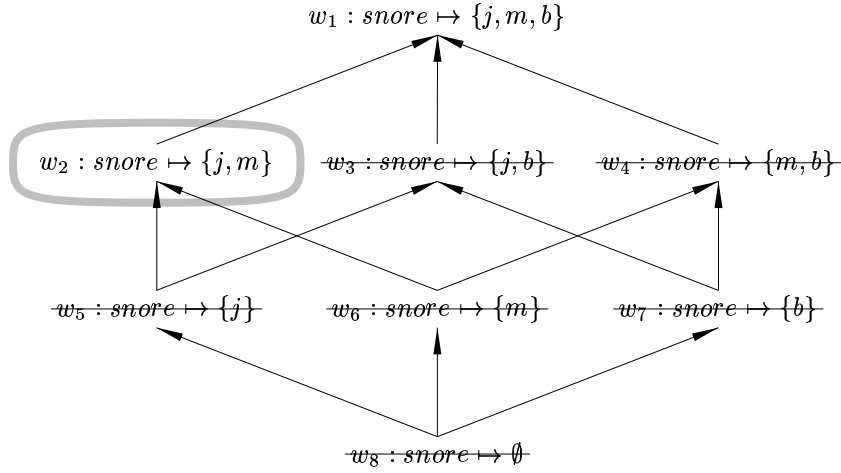


Figure 6.1: The \langle_{snore} ordering: $w_8 < w_5$, $w_8 < w_6$, $w_8 < w_7$, $w_5 < w_2$, $w_5 < w_3$, $w_6 < w_2$, $w_6 < w_4$, etc.—the direction of the arrow reflects the *snore*-smaller relation. The worlds w_3, \dots, w_8 do not belong to the normal interpretation of *John and Mary snore*, since $F(snore)$ does not contain both j and m in those worlds. Among the remaining worlds w_2 is minimal with respect to \langle_{snore} .

recall the question answer pair (570)–(571) discussed in Chapter 5 (Section 5.6). As I argued in Section 5.4.1, the distributivity of predicates of location such as *in the box* is best accounted for in terms of summative distributivity, i.e. the interpretation of the predicate includes not just atomic objects but also their sums, cf. (572). Furthermore, if we take Link (1983) seriously, and distinguish between “things” and portions of matter that constitute those things, then at least another meaning postulate will be needed to make sure that whenever an individual is in the box, the stuff that makes up that individual is in the box too, and vice versa, cf. (573).

(570) What is in the box?

(571) A ring.

(572) $\forall x, y[[in\ the\ box(x) \wedge in\ the\ box(y)] \leftrightarrow in\ the\ box(x \oplus y)]$

(573) $\forall x, y[x \triangleright y \rightarrow [in\ the\ box(x) \leftrightarrow in\ the\ box(y)]]$

Now suppose our domain of individuals D is $\{a, A, b, B, a \oplus b, A + B\}$: a and b are two atomic “things”, whereas A and B are portions of matter that constitute them, respectively. Further, $a \oplus b$ is the *individual sum* of a and b , a plural object made up by these two individuals. In turn $A + B$ is the *material sum* of the respective portions of matter, which is, according to Link’s proposal, itself a singular object.⁶ Similarly, I will assume that $A + B$ constitutes $a \oplus b$.

⁶For simplicity I will assume that individual sum \oplus is only defined for proper individuals, or “things”, whereas the material sum $+$ is only defined for portions of “stuff”.

	<i>in the box</i> \mapsto			
	$\left\{ \begin{array}{l} a, b, A, B \\ a \oplus b, A + B \end{array} \right\}$	$\{a, A\}$	$\{b, B\}$	\emptyset
<i>ring</i> $\mapsto \{a, b\}$	$\{w_{11}\}$	$\{w_{12}\}$	$\{w_{13}\}$	w_{14}
<i>ring</i> $\mapsto \{a\}$	$\{w_{21}\}$	$\{w_{22}\}$	w_{23}	w_{24}
<i>ring</i> $\mapsto \{b\}$	$\{w_{31}\}$	w_{32}	$\{w_{33}\}$	w_{34}
<i>ring</i> $\mapsto \emptyset$	w_{41}	w_{42}	w_{43}	w_{44}

Table 6.2: The interpretation function F : For each world, the value of $F(\textit{in the box})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{ring})$ in the corresponding row. For instance in w_{42} , F maps *in the box* to $\{a, A\}$ and *ring* to the empty set. The dashed ovals highlight the worlds that belong to the non-exhaustive interpretation of *A ring is in the box*—worlds where the intersection of $F(\textit{in the box})$ and $F(\textit{ring})$ is non-empty. The worlds in the solid line oval constitute the exhaustive interpretation of *A ring is in the box* with respect to the question predicate *in the box*.

In such a domain, the predicate *in the box* can have at most four different extensions that conform to the meaning postulates (572) and (573). These include the whole domain D , the sets $\{a, A\}$ and $\{b, B\}$, and the empty set. Notice that for instance, such sets as $\{a, A, b, B\}$ or $\{a, b, a \oplus b\}$ are not among these possibilities. The first one is excluded by summative distributivity (572), and the second is inconsistent with (573). As for the predicate *ring*, I will assume for simplicity that it only applies to atomic “things”, and not to portions of stuff, and hence also has four possible extensions in the given domain: $\{a, b\}$, $\{a\}$, $\{b\}$ and \emptyset . Thus we need at least 16 worlds to reflect all possible combinations of the extensions of these two predicates. Let’s assume that W indeed contains exactly 16 worlds, those represented in Table 6.2. Note that a world where, let’s say $F(\textit{in the box}) = \{a, b, a \oplus b\}$ is simply not included because the meaning postulate (573) rules it out.

So what is the exhaustive meaning of the answer *a ring* to the question *What is in the box?* in such a model? Assuming that the logical form of the answer is (574), the literal interpretation contains the worlds with a non-empty intersection of the set of rings and the set of things that are in the box (highlighted with dashed ovals in Table 6.2). These worlds include the possibility that exactly one ring makes up the whole contents of the box, e.g. w_{12} , but they also allow for the option that there are two rings in the box (w_{11}), or a ring and something else (e.g. w_{21}).

$$(574) \exists x[\textit{ring}(x) \wedge \textit{in the box}(x)]$$

Next we have to find the $<_{in\ the\ box}$ -minimal worlds among those in the normal interpretation of the answer. Due to the *ceteris paribus* condition in the definition of $<_P$ (564), only the worlds with equal extensions of the predicate *ring* are comparable (worlds within one row of Table 6.2). This makes for instance w_{12} and w_{13} smaller than w_{11} , and w_{22} and w_{23} smaller than w_{21} , but e.g. w_{22} is neither smaller nor greater than w_{11} . The $<_{in\ the\ box}$ -ordering for worlds w_{11} – w_{14} and w_{21} – w_{24} is represented graphically in Figures 6.2 and 6.3. It is easy to see that among the worlds consistent with (574), w_{12} and w_{13} are minimal in the first group and w_{22} in the second (grey ovals in Figures 6.2 and 6.3), since the extension of *in the box* in those worlds is a proper subset of that in w_{11} and w_{21} , respectively. Similarly, w_{33} is the $<_{in\ the\ box}$ -smaller one of w_{31} and w_{33} . Thus this leaves us with four minimal worlds in the exhaustive interpretation of the answer, cf. (575).⁷ (See also the solid line highlighting in Table 6.2.)

$$(575) \text{ exh}^W(\exists x[\text{ring}(x) \wedge \text{in the box}(x)], \text{in the box}) = \{w_{12}, w_{13}, w_{22}, w_{33}\}$$

Notice that in all these worlds there is just one ring in the box, and no other object distinct from it. This corresponds to the intuitions of the exhaustive interpretation of (571). However, the portion of matter that makes up that ring is not excluded, so strictly speaking, the box contains two individuals, the ring (a or b) and the stuff it is made of (A or B). It is also quite obvious that if the answer were *two rings*, its exhaustive interpretation $\{w_{11}\}$ would neither exclude the material of those two rings nor the individual rings from the box’ contents, simply because exhaustification chooses between the *real* options available in the model and the possibility where just the two rings $a \oplus b$ are in the box but not the material or not ring a or b is not available. This is a remarkable result that shows that van Rooij and Schulz’ notion of exhaustive interpretation respects all the information contained in the model, in particular the lexical properties of the question predicate, regardless of the details of the assumed analysis of plurals and mass terms and the availability of distributivity operators or “materiality” operators, which would also be needed for the analysis of this example.

To sum up, van Rooij and Schulz use the main idea implemented in Groenendijk and Stokhof’s definition of exhaustification—the minimisation of the question predicate—but make it sensitive to all the information contained in the model including the meaning postulates that reflect the peculiarities of the lexical semantics of the question predicate. I have illustrated the application of this approach to the interpretation of single answers to questions. The next section demonstrates how it works with restatements.

6.2 Restatements in minimal information states

As I emphasised in the previous section, exhaustive interpretation in van Rooij and Schulz’ proposal respects all the information contained in the model. This was illustrated with special reference to the meaning postulates. However, this “information sensitivity” is not restricted to meaning postulates. That is, if the space of possibilities W is taken to represent the common ground of the discourse participants, any information in that common ground can in principle

⁷Note that in the given model, the result for this example would have also been the same without the *ceteris paribus* condition in the definition of $<_P$ (564).

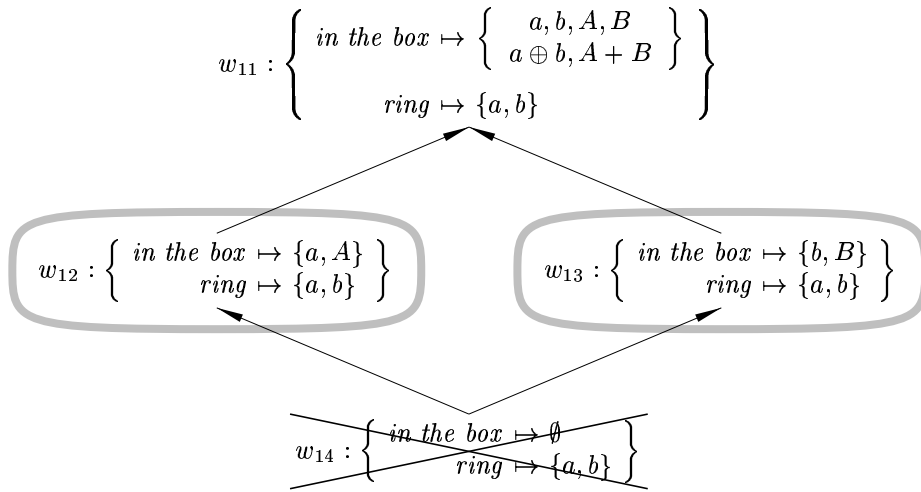


Figure 6.2: The $<_{in\ the\ box}$ ordering: $w_{14} < w_{12}$, $w_{14} < w_{13}$, $w_{12} < w_{11}$, $w_{13} < w_{11}$. The world w_{14} does not belong to the normal interpretation of *A ring is in the box*, since the intersection of $F(ring)$ and $F(in\ the\ box)$ in that world is empty. Among the remaining worlds w_{12} and w_{13} are minimal with respect to $<_{in\ the\ box}$.

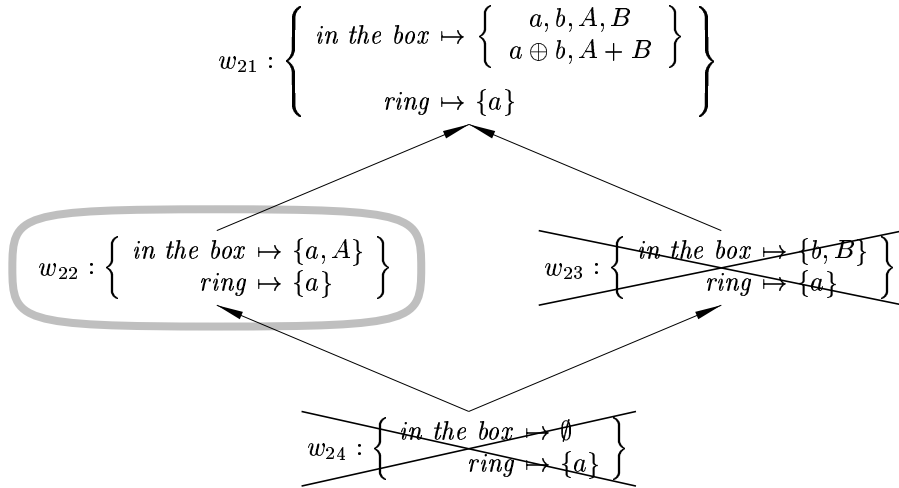


Figure 6.3: The $<_{in\ the\ box}$ ordering: $w_{24} < w_{22}$, $w_{24} < w_{23}$, $w_{22} < w_{21}$, $w_{23} < w_{21}$. The worlds w_{23} and w_{24} do not belong to the normal interpretation of *A ring is in the box*, since the intersection of $F(ring)$ and $F(in\ the\ box)$ in those worlds is empty. Among the remaining worlds w_{22} is minimal with respect to $<_{in\ the\ box}$.

affect the result of exhaustification. Section 6.3 will discuss some problematic consequences of this view, but here I will concentrate on cases where the impact of information on the result of exhaustification is minimal. Thus in this section I will assume that the set of worlds W contains *no information* except the meaning postulates, i.e. *all* worlds that conform to constraints on the interpretation of linguistic expressions are in W . This assumption was made in the analyses of the single answers in the previous section, and now we shall analyse restatements against the same background.

The rest of this section is divided into two parts. First (Section 6.2.1), I will consider the question how two exhaustive interpretations in van Rooij and Schulz' sense can be combined to form a restatement, which will also serve as a perfect occasion to introduce another element of their theory—the view of exhaustive interpretation as a *dynamic interpretation function*. Section 6.2.2 then presents a number of examples.

6.2.1 Combining exhaustive meanings

Recall that in Groenendijk and Stokhof's setting (Chapter 5) we simply *conjoined* the exhaustifications of two NPs or sentences in order to form a restatement. However, in the framework developed by van Rooij and Schulz, such conjunction does not make much sense, since the outcome of exhaustification is not a formula. Rather, it is a set of worlds—an object of the same nature as an intension of a proposition, cf. (562) repeated in (576). In this way van Rooij and Schulz implement one of their central claims that exhaustive interpretation is (as the name suggests) *a mode of interpretation*, on a par with the normal, non-exhaustive interpretation function.⁸

$$(576) \text{exh}^W(A, P) = \{w \in [A]^W \mid \neg \exists v \in [A]^W [v <_P w]\}$$

Moreover, exhaustive interpretation can be viewed as a *dynamic interpretation function* that realizes a transition from one information state (the set of worlds W in (576)) to another (the resulting set of worlds).⁹ Thus (576) can be reformulated as (577), where s is the input information state and $s[A]$ is the information state resulting from the non-exhaustive update of s with proposition A .¹⁰ The set of worlds W which includes all the possibilities except those inconsistent with the meaning postulates thus forms the minimal information state with respect to the update process ($W = s_0$).

$$(577) \text{exh}_{dyn}^s(A, P) = \{w \in s[A] \mid \neg \exists v \in s[A] [v <_P w]\}$$

In dynamic semantics, one normally thinks of discourse meaning as a result of successive update of the initial information state with the meanings of sentences one by one. Thus, we first update the initial information state s_0 with the first sentence S_1 , and then the resulting state $s_0[S_1]$ is updated with the next sentence ($s_0[S_1][S_2]$), and so on. This suggests that the exhaustive interpreta-

⁸According to van Rooij and Schulz (2004b), the opposition of the non-exhaustive and the exhaustive interpretation mode should reflect the distinction between semantic and pragmatic interpretation.

⁹This aspect of van Rooij and Schulz' theory owes its main ideas to Zeevat (1994a).

¹⁰Any standard dynamic update function that operates on sets of worlds would do for our purposes (e.g. Veltman, 1996). A fully explicit definition of dynamic interpretation in the final version of the proposed theory will be spelled out in Appendix B.

tions of two answers should be combined in the same way. The outcome of the exhaustive update of state s with A_1 ($exh_{dyn}^s(A_1, P)$) serves as the set of worlds in which the second answer A_2 is interpreted exhaustively. In other words, the successive exhaustive interpretation of two answers boils down to (578).

$$(578) \text{ } exh_{dyn}^{[exh_{dyn}^s(A_1, P)]}(A_2, P)$$

For the sake of readability and at the same time to emphasise the status of exhaustification as a variety of dynamic interpretation function, I will use the update notation $s[[\cdot]]$ not only for the classical but also for the exhaustive update and write $s[[A]]_{exh}^P$ instead of $exh_{dyn}^s(A, P)$. This makes (578) equivalent to (579), and the definition of dynamic exhaustification (577) can be reformulated as (580).

$$(579) s[[A_1]]_{exh}^P [[A_2]]_{exh}^P$$

$$(580) s[[A]]_{exh}^P = \{w \in s[[A]] \mid \neg \exists v \in s[[A]][v <_P w]\}$$

With these assumptions and notational conventions, we can now study some examples of restatements.

6.2.2 Examples of restatements

In this section we will consider a number of typical cases of restatement for which van Rooij and Schulz' approach reproduces nicely the results of Groenendijk and Stokhof's. Let's start with a nominal restatement involving coreferring groups of equal size, such as (582).¹¹

(581) Who is in the room?

(582) a. Two linguists. John and Mary.

b. John and Mary. Two linguists.

Recall that the main idea behind the analysis of such examples is that the coreference of the NPs *two linguists* and *John and Mary* is a consequence of the exhaustive interpretation of each of these NPs with respect to the same question predicate *in the box*. That is, when the first NP is uttered with a completion intonation (here and further indicated by a period), it is interpreted as the complete answer to the question: two linguists are in the room *and no one else*. But if no one else is in the room then John and Mary cannot be someone else, i.e. they must form part of the two linguists that are in the room. But since the NP *John and Mary* also bears a completion intonation, it is interpreted as an exhaustive answer, too. By the same reasoning we get that the two linguists must be part of John and Mary, and if two groups are part of each other then they are equal. Hence the NPs *two linguists* and *John and Mary* refer to the same group of individuals.

In Chapter 5 it was shown that Groenendijk and Stokhof's implementation of the notion of exhaustivity (with Bonomi and Casalegno's amendment, cf. Section 5.4.2) captures this inference. Within van Rooij and Schulz' approach, the same conclusion can be reached with the mechanism of the question predicate

¹¹A similar example (473a) was analysed in Section 5.4.3 within Groenendijk and Stokhof's setting.

minimisation via the $<_{in\ the\ room}$ -relation on possible worlds. To illustrate this, let's again construct an appropriate model.

For instance, let's take the domain of individuals D to be $\{j, m, b, j \oplus m, j \oplus b, m \oplus b, j \oplus m \oplus b\}$ again and assume that the question predicate *in the room* is summatively distributive (583), just like the predicate *in the box* in the previous section, cf. (572). However, this time I will ignore portions of matter for simplicity. The predicate *linguist* will be assumed to contain only atoms. This implies 8 possible extensions for each of these predicates in the given domain enumerated in (584) and (585), respectively.

(583) $\forall x, y[[in\ the\ room(x) \wedge in\ the\ room(y)] \leftrightarrow in\ the\ room(x \oplus y)]$

(584) Possible extensions of the predicate *in the room*:

- a. $\{j \oplus m \oplus b, j \oplus m, j \oplus b, m \oplus b, j, m, b\}$,
- b. $\{j \oplus m, j, m\}, \{j \oplus b, j, b\}, \{m \oplus b, m, b\}$,
- c. $\{j\}, \{m\}, \{b\}$,
- d. \emptyset

(585) Possible extensions of the predicate *linguist*:

- a. $\{j, m, b\}$,
- b. $\{j, m\}, \{j, b\}, \{m, b\}$,
- c. $\{j\}, \{m\}, \{b\}$,
- d. \emptyset

The minimal information state s_0 will contain no information beyond the meaning postulates, i.e. all the worlds consistent with the constraints on the meaning of *in the room* and *linguist* will be in s_0 . On the assumption that each possible combination of the extensions of these predicates is realised in only one world, s_0 contains 64 worlds, all represented in Table 6.3. For each world in Table 6.3, the extension of the predicate *in the room* in that world is given in the heading of the corresponding column, and the extension of *linguist* in the corresponding row. For instance in w_{31} , all of John, Mary and Bill are in the room, but only John and Bill are linguists.¹²

The last building block that is needed is a logical form for the answers *two linguists* and *John and Mary*. Like before there are two options—a collective and a distributive reading. For instance, *Two linguists are in the room* is ambiguous between (586a) and (586b), as a consequence of either the lexical ambiguity of the NP, or the optional application of a distributivity operator. The same holds for *John and Mary are in the room*, cf. (587). However, due to the summative distributivity of the question predicate *in the room* (583) the collective and the distributive reading lead to identical interpretations, as will become clear presently.

(586) a. $\exists x \exists y[x \neq y \wedge linguist(x) \wedge linguist(y) \wedge in\ the\ room(x \oplus y)]$
 b. $\exists x \exists y[x \neq y \wedge linguist(x) \wedge linguist(y) \wedge in\ the\ room(x) \wedge in\ the\ room(y)]$

(587) a. *in the room*($j \oplus m$)
 b. *in the room*(j) \wedge *in the room*(m)

Let's first test the notion of dynamic exhaustification on (582a) and use, for

¹²The heading of the first column $\{j, m, b, \dots, j \oplus m \oplus b\}$ abbreviates $\{j, m, b, j \oplus m, j \oplus b, m \oplus b, j \oplus m \oplus b\}$ in Table 6.3.

<i>linguist</i>	<i>in the room</i>							
	$\{j, m, b, \dots\}$ $\{j \oplus m \oplus b\}$	$\{j, m\}$ $\{j \oplus m\}$	$\{j, b\}$ $\{j \oplus b\}$	$\{m, b\}$ $\{m \oplus b\}$	$\{j\}$	$\{m\}$	$\{b\}$	\emptyset
$\{j, m, b\}$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	w_{16}	w_{17}	w_{18}
$\{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	w_{26}	w_{27}	w_{28}
$\{j, b\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	w_{36}	w_{37}	w_{38}
$\{m, b\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	w_{46}	w_{47}	w_{48}
$\{j\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	w_{56}	w_{57}	w_{58}
$\{m\}$	w_{61}	w_{62}	w_{63}	w_{64}	w_{65}	w_{66}	w_{67}	w_{68}
$\{b\}$	w_{71}	w_{72}	w_{73}	w_{74}	w_{75}	w_{76}	w_{77}	w_{78}
\emptyset	w_{81}	w_{82}	w_{83}	w_{84}	w_{85}	w_{86}	w_{87}	w_{88}

Table 6.3: The interpretation function F : For each world, the value of $F(\textit{in the room})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{linguist})$ in the corresponding row. The heading of the first column $\{j, m, b, \dots, j \oplus m \oplus b\}$ is an abbreviation for $\{j, m, b, j \oplus m, j \oplus b, m \oplus b, j \oplus m \oplus b\}$. The green ovals (dashed or solid line) highlight the worlds that belong to the non-exhaustive interpretation of *Two linguists are in the room*: $s_0 \llbracket \exists x \exists y [x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{in the room}(x \oplus y)] \rrbracket$. The worlds in the solid line green ovals constitute the exhaustive interpretation of *Two linguists are in the room* with respect to the question predicate *in the room*: $s_0 \llbracket \exists x \exists y [x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{in the room}(x \oplus y)] \rrbracket_{exh}^{in\ the\ room}$. The red ovals mark worlds that belong to the subsequent exhaustive update of the resulting information state with *John and Mary are in the room* (which coincides with the non-exhaustive update): $s_0 \llbracket \exists x \exists y [x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{in the room}(x \oplus y)] \rrbracket_{exh}^{in\ the\ room} \llbracket \textit{in the room}(j \oplus m) \rrbracket_{exh}^{in\ the\ room}$.

instance, the collective readings (586a) and (587a). Thus we first perform the exhaustive update of the initial information state with $\exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \text{in the room}(x \oplus y)]$, and then the resulting information state is updated with *in the room*($j \oplus m$), cf. (588).

$$(588) s_0 [\exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \text{in the room}(x \oplus y)]]_{exh}^{in\ the\ room} \\ \llbracket \text{in the room}(j \oplus m) \rrbracket_{exh}^{in\ the\ room}$$

The worlds that constitute the non-exhaustive update of s_0 with the first answer are marked with green ovals (dashed or solid line) in Table 6.3, cf. also (589). These are the worlds where a complex individual $x \oplus y$ constituted by some two linguists x and y happens to be in the room. It is quite obvious that if we had used the distributive reading of *two linguists* (586b) and were looking for worlds where the extension of *in the room* includes two distinct elementary linguists, we would have found precisely the same worlds, since *in the room*(x) \wedge *in the room*(y) whenever *in the room*($x \oplus y$), due to the summative distributivity of *in the room* (583).

$$(589) s_0 [\exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \text{in the room}(x \oplus y)]] = \\ \{w_{11}, w_{12}, w_{13}, w_{14}, w_{21}, w_{22}, w_{31}, w_{33}, w_{41}, w_{44}\}$$

Further minimisation of the question predicate *in the room* via the $<_{in\ the\ room}$ relation proceeds along the same lines as in an earlier example illustrated in Figure 6.1, p. 220. It discards the worlds in which more than just the two linguists are in the room. The remaining worlds are highlighted with green solid line ovals in Table 6.3, and are listed in (590). They form the exhaustive interpretation of *Two linguists are in the room* in s_0 .

$$(590) s_0 [\exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \text{in the room}(x \oplus y)]]_{exh}^{in\ the\ room} \\ = \{w_{12}, w_{13}, w_{14}, w_{22}, w_{33}, w_{44}\}$$

Clearly, if two linguists and no one else are in the room then John and Mary must be linguists if they are in the room. This is exactly what the processing of the second answer gives us. The non-exhaustive update picks out from (590) the worlds that are consistent with *in the room*($j \oplus m$), i.e. where the complex individual $j \oplus m$ is among the elements of *in the room*'s extension, cf. (591).¹³ In the given model, this is fulfilled in only two worlds w_{12} and w_{22} (red in Table 6.3), and since the question predicate has already been minimised, no comparable worlds wrt. $<_{in\ the\ room}$ are left in the current information state, hence exhaustification does not delete any further worlds, and the exhaustive interpretation turns out to equal the non-exhaustive one, cf. (592).

$$(591) \{w_{12}, w_{13}, w_{14}, w_{22}, w_{33}, w_{44}\} \llbracket \text{in the room}(j \oplus m) \rrbracket = \{w_{12}, w_{22}\}$$

$$(592) \{w_{12}, w_{13}, w_{14}, w_{22}, w_{33}, w_{44}\} \llbracket \text{in the room}(j \oplus m) \rrbracket_{exh}^{in\ the\ room} = \{w_{12}, w_{22}\}$$

The most important result of this computation is that John and Mary are linguists in both w_{12} and w_{22} , as expected. Thus the mechanism of predicate circumscription as used in van Rooij and Schulz' proposal allows us to infer the coreference of NPs *two linguists* and *John and Mary* in a restatement like (582a). In other words, we reproduced the result achieved with Groenendijk

¹³The distributive reading of *John and Mary* (587b) leads to the same result, for the same reasons as discussed above.

and Stokhof’s exhaustification operator in Chapter 5, with the difference that no distributivity operators or the like were needed to get a consistent exhaustive interpretation of the single answers, the result is completely independent of the treatment of collectivity/distributivity of the NPs.

Next we shall take a brief look at the restatement with the reversed order of the NPs (582b): *John and Mary. Two linguists*. In Groenendijk and Stokhof’s setting, the order of the NPs did not play any role. The exhaustive interpretations of (582a) and (582b) were always identical since we used classical conjunction to connect the exhaustification of the single answers, and conjunction is commutative. But in the dynamic semantics we are using now, neither is it necessarily the case that $s[\phi \wedge \psi] = s[\psi \wedge \phi]$ (or equivalently, $s[\phi][\psi] = s[\psi][\phi]$), nor is the order of exhaustive update generally reversible, i.e. $s[\phi]_{exh}^P[\psi]_{exh}^P$ may not be equal to $s[\psi]_{exh}^P[\phi]_{exh}^P$.

However, in restatements like (582) the order of occurrence of the NPs happens to play no role, neither for the non-exhaustive nor for the exhaustive update.¹⁴ Compare Table 6.3 and Table 6.4. In the latter, the worlds in the non-exhaustive update of s_0 with *John and Mary are in the room* are marked red, whereas the solid line marking selects the subset that corresponds to the exhaustive interpretation $s_0[in\ the\ room(j \oplus m)]_{exh}^{in\ the\ room}$. From the resulting set, only two worlds survive further non-exhaustive as well as exhaustive update with *Two linguists are in the room*. These are again the worlds w_{12} and w_{22} , highlighted in green. Thus the observation that (582a) and (582b) have the same meaning and the NPs corefer in both is captured within van Rooij and Schulz’ approach to exhaustification as well.

To summarise so far, the above example illustrates the inference of coreference in a nominal restatement involving groups of equal size and compatible descriptions (i.e. there is nothing contradictory in *John and Mary* and *two linguists* denoting the same group of individuals). It should be quite obvious that singular restatements as well as plural restatements like *Two linguists. A student and a professor*. can be analysed along the same lines with essentially the same result.

Another example that is worth considering is an infelicitous restatement that involves two incompatible descriptions, such as (594). Recall that the proposed intuitive explanation of the infelicity of (594) was that the exhaustive interpretation of *a child* to the question *Who is in the room?* implies that no one but a child is in the room. The lexical semantics of the nouns *child* and *adult* excludes that a child be an adult at the same time. Therefore, no adult is in the room, which is inconsistent with the second part of the answer.

(593) Who is in the room?

- (594) a. # A child. An adult.
 b. # An adult. A child.

¹⁴The non-exhaustive updates $s[\phi][\psi]$ and $s[\psi][\phi]$ may be unequal if ϕ or ψ contains epistemic operators such as *might* (Veltman, 1996). In a setting where information states are also employed to pass on information about the values of variables, the presence of anaphoric expressions may affect the order reversibility, too (Dekker, 1993, e.g.). As far as the exhaustive update is concerned, $s[\phi]_{exh}^P[\psi]_{exh}^P$ may be different from $s[\psi]_{exh}^P[\phi]_{exh}^P$ if ϕ and ψ are NPs denoting groups of unequal size. One such example will be discussed in Section 6.3.1. However, as long as the restatement is formed by groups of the same size and the order of ϕ and ψ in the non-exhaustive update is reversible, it is reversible in the exhaustive update, too.

<i>linguist</i>	<i>in the room</i>							
	$\left\{ \begin{matrix} j, m, b, \dots \\ j \oplus m \oplus b \end{matrix} \right\}$	$\left\{ \begin{matrix} j, m \\ j \oplus m \end{matrix} \right\}$	$\left\{ \begin{matrix} j, b \\ j \oplus b \end{matrix} \right\}$	$\left\{ \begin{matrix} m, b \\ m \oplus b \end{matrix} \right\}$	$\{j\}$	$\{m\}$	$\{b\}$	\emptyset
$\{j, m, b\}$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	w_{16}	w_{17}	w_{18}
$\{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	w_{26}	w_{27}	w_{28}
$\{j, b\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	w_{36}	w_{37}	w_{38}
$\{m, b\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	w_{46}	w_{47}	w_{48}
$\{j\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	w_{56}	w_{57}	w_{58}
$\{m\}$	w_{61}	w_{62}	w_{63}	w_{64}	w_{65}	w_{66}	w_{67}	w_{68}
$\{b\}$	w_{71}	w_{72}	w_{73}	w_{74}	w_{75}	w_{76}	w_{77}	w_{78}
\emptyset	w_{81}	w_{82}	w_{83}	w_{84}	w_{85}	w_{86}	w_{87}	w_{88}

Table 6.4: The interpretation function F : For each world, the value of $F(\textit{in the room})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{linguist})$ in the corresponding row. For instance in w_{31} , F maps *in the room* to $\{j, m, b, j \oplus m, j \oplus b, m \oplus b, j \oplus m \oplus b\}$ and *linguist* to $\{j, b\}$. The red ovals (dashed or solid line) highlight the worlds that belong to the non-exhaustive interpretation of *John and Mary are in the room*: $s_0 \llbracket \textit{in the room}(j) \wedge \textit{in the room}(m) \rrbracket$. The worlds in the solid line red ovals constitute the exhaustive interpretation of *John and Mary are in the room* with respect to the question predicate *in the room*: $s_0 \llbracket \textit{in the room}(j) \wedge \textit{in the room}(m) \rrbracket_{exh}^{in\ the\ room}$. The green ovals mark worlds that belong to the subsequent exhaustive update of the resulting information state with *Two linguists are in the room* (which coincides with the non-exhaustive update): $s_0 \llbracket \textit{in the room}(j) \wedge \textit{in the room}(m) \rrbracket_{exh}^{in\ the\ room} \llbracket \exists x \exists y [\textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{in the room}(x) \wedge \textit{in the room}(y)] \rrbracket_{exh}^{in\ the\ room}$.

This inconsistency arises when the first NP alone is already interpreted exhaustively, which is triggered by the completion intonation and the absence of other overt cues that the NPs are connected, such as a conjunction *and*. However, if a conjunction is used as in (595), exhaustive interpretation does not take place until the whole conjoined NP is processed, hence no contradiction arises.

(595) A child and an adult.

In what follows I will sketch out how this account works if exhaustification is understood in van Rooij and Schulz' terms. I will make the same assumptions regarding the distributive character of the question predicate *in the room* as in the previous example, cf. (583), but consider a smaller domain $\{j \oplus m, j, m\}$ which gives rise to only four possible extensions for this predicate: $\{j \oplus m, j, m\}$, $\{j\}$, $\{m\}$, and \emptyset . The extensions of both *child* and *adult* will be taken to consist of atoms, which also allows for four possible extensions for each predicate: $\{j, m\}$, $\{j\}$, $\{m\}$, or \emptyset . However, not all combinations of the extensions of *child* and *adult* are possible. Due to the meaning postulate (596) that captures the idea that children and adults are disjoint sets, many combinations, e.g. $F(\textit{child})(w) = \{j\}$ and $F(\textit{adult})(w) = \{j, m\}$, will not be realised in any world. The whole space of possibilities for the given three predicates is summarised in Table 6.5 (with the usual assumption that each combination of possible extensions is represented by exactly one world).

(596) $\forall x[\textit{child}(x) \rightarrow \neg\textit{adult}(x)]$

The non-exhaustive and the exhaustive update of the initial information state s_0 with *A child is in the room* is given in (597) and (598), respectively (see also the green and green solid line highlighting in Table 6.5). However, in none of the worlds in the exhaustive interpretation of this utterance is it the case that an adult is in the room. That is, further update with *An adult is in the room*, both non-exhaustive and exhaustive, leads to an absurd state, cf. (599).

(597) $s_0[\exists x[\textit{child}(x) \wedge \textit{in the room}(x)]] = \{w_{11}, w_{12}, w_{13}, w_{21}, w_{22}, w_{31}, w_{32}, w_{41}, w_{43}, w_{51}, w_{53}\}$

(598) $s_0[\exists x[\textit{child}(x) \wedge \textit{in the room}(x)]]_{exh}^{in the room} = \{w_{12}, w_{13}, w_{22}, w_{32}, w_{43}, w_{53}\}$

(599) $s_0[\exists x[\textit{child}(x) \wedge \textit{in the room}(x)]]_{exh}^{in the room}[\exists x[\textit{adult}(x) \wedge \textit{in the room}(x)]]_{exh}^{in the room} = \emptyset$

Similarly, if the order of NPs is reversed, cf. (594b), and we start with $\exists x[\textit{adult}(x) \wedge \textit{in the room}(x)]$, the exhaustive update results in a set of worlds that do not support $\exists x[\textit{child}(x) \wedge \textit{in the room}(x)]$, see (601) and the worlds marked with red solid line in Table 6.5. Thus, after updating $s_0[\exists x[\textit{adult}(x) \wedge \textit{in the room}(x)]]_{exh}^{in the room}$ with the second answer, we again end up in an absurd state, cf. (602).

(600) $s_0[\exists x[\textit{adult}(x) \wedge \textit{in the room}(x)]] = \{w_{21}, w_{23}, w_{41}, w_{42}, w_{61}, w_{62}, w_{63}, w_{71}, w_{72}, w_{81}, w_{83}\}$

(601) $s_0[\exists x[\textit{adult}(x) \wedge \textit{in the room}(x)]]_{exh}^{in the room} = \{w_{23}, w_{42}, w_{62}, w_{63}, w_{72}, w_{83}\}$

	<i>in the room</i> \mapsto			
	$\{j, m, j \oplus m\}$	$\{j\}$	$\{m\}$	\emptyset
$child \mapsto \{j, m\}$ $adult \mapsto \emptyset$	w_{11}	w_{12}	w_{13}	w_{14}
$child \mapsto \{j\}$ $adult \mapsto \{m\}$	w_{21}	w_{22}	w_{23}	w_{24}
$child \mapsto \{j\}$ $adult \mapsto \emptyset$	w_{31}	w_{32}	w_{33}	w_{34}
$child \mapsto \{m\}$ $adult \mapsto \{j\}$	w_{41}	w_{42}	w_{43}	w_{44}
$child \mapsto \{m\}$ $adult \mapsto \emptyset$	w_{51}	w_{52}	w_{53}	w_{54}
$child \mapsto \emptyset$ $adult \mapsto \{j, m\}$	w_{61}	w_{62}	w_{63}	w_{64}
$child \mapsto \emptyset$ $adult \mapsto \{j\}$	w_{71}	w_{72}	w_{73}	w_{74}
$child \mapsto \emptyset$ $adult \mapsto \{m\}$	w_{81}	w_{82}	w_{83}	w_{84}
$child \mapsto \emptyset$ $adult \mapsto \emptyset$	w_{91}	w_{92}	w_{93}	w_{94}

Table 6.5: The interpretation function F : For each world, the value of $F(\textit{in the room})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{child})$ and $F(\textit{adult})$ in the corresponding row. The following propositions are highlighted: the non-exhaustive interpretation of *A child is in the room* in the initial information state s_0 : $s_0[\exists x[\textit{child}(x) \wedge \textit{in the room}(x)]]$ (green, dashed or solid); its exhaustive interpretation with respect to the question predicate *in the room*: $s_0[\exists x[\textit{child}(x) \wedge \textit{in the room}(x)]]_{exh}^{in\ the\ room}$ (green solid); the non-exhaustive interpretation of *An adult is in the room* in the initial information state s_0 : $s_0[\exists x[\textit{adult}(x) \wedge \textit{in the room}(x)]]$ (red, dashed or solid); its exhaustive interpretation with respect to the question predicate *in the room*: $s_0[\exists x[\textit{adult}(x) \wedge \textit{in the room}(x)]]_{exh}^{in\ the\ room}$ (red solid).

$$(602) s_0 [\exists x [\text{adult}(x) \wedge \text{in the room}(x)]]_{exh}^{in the room} [\exists x [\text{child}(x) \wedge \text{in the room}(x)]]_{exh}^{in the room} = \emptyset$$

By contrast, the exhaustive interpretation of the conjunction *a child and an adult* (595) as a whole does not lead to any absurdities, since it is compatible with the fact that the child and the adult are two distinct individuals. In the given model, both the normal interpretation of this NP (603) and the exhaustive interpretation with respect to the question predicate *in the room* (604) result in a non-empty information state $\{w_{21}, w_{41}\}$ —the worlds in which the extension of *in the room* contains one individual that is a child and another individual that is an adult, cf. Table 6.5.

$$(603) s_0 [\exists x \exists y [\text{child}(x) \wedge \text{adult}(y) \wedge \text{in the room}(x \oplus y)]] = \{w_{21}, w_{41}\}$$

$$(604) s_0 [\exists x \exists y [\text{child}(x) \wedge \text{adult}(y) \wedge \text{in the room}(x \oplus y)]]_{exh}^{in the room} = \{w_{21}, w_{41}\}$$

The examples presented in this section thus illustrate all the three main cases which I proposed to explain in terms of exhaustification (cf. (315) in Chapter 4). These include (a) the inference of coreference in a sequence of asyndetically connected NPs; (b) the inference of contradiction if the NPs that are formed by incompatible descriptions; and (c) the lack of a coreference requirement in overtly conjoined NPs. We saw that the notion of exhaustive interpretation proposed by van Rooij and Schulz (2004b) can in principle deal with all three cases and produces largely the same results as Groenendijk and Stokhof’s approach discussed in Chapter 5. At least, this is so if the restatements are interpreted in minimal information states—states of common knowledge of the discourse participants that contain no information beyond the meaning postulates, i.e. beyond the participants’ competence in the lexical semantics of the language they use. The next section will consider the possible effects of richer information accumulated in the common ground on the exhaustive interpretation, and hence on the interpretation of restatements.

6.3 Accumulating information

One of the functions of the information state in dynamic semantics is to accumulate information processed by the discourse participants in the course of communication. Update essentially consists in adding the information contained in an utterance to the information state, where it stays.¹⁵ Thus all following utterances are interpreted against the background of the information previously processed, which makes interactions between the new and the old information possible. Exhaustive update as defined in (580) in the previous chapter (cf. below) on the basis of van Rooij and Schulz’ definition (577) can also give rise to such interactions. Obviously, since exhaustification selects worlds with minimal extension of the question predicate P among those in the non-exhaustive update of the *current* information state $s[A]$, automatically, it only considers possibilities that are consistent with the whole load of information already contained in s , which includes all the contribution of the whole previous discourse.

¹⁵To be more precise, this is a feature of the variety of dynamic systems called *update semantics* (Veltman, 1996; Dekker, 1993, e.g.). The sort of dynamic semantics I have been assuming all along belongs to this class.

$$(605) s[[A]]_{exh}^P = \{w \in s[[A]] \mid \neg \exists v \in s[[A]][v <_P w]\}$$

In this section, I will discuss some problematic consequences for the interpretation of restatements caused by this utmost “information sensitivity” of exhaustive update in the current definition. One group of problems concerns cases where the information contained in the first utterance of a restatement affects the exhaustive interpretation of the second utterance. This case is discussed in Section 6.3.1. Another group of problems arises where the whole restatement is interpreted in a non-minimal information state, or more specifically, in a state that already contains some information on the question asked, cf. Section 6.3.2.

In Section 6.3.3, I argue for a solution that draws a sharp distinction between lexical semantics realised in the meaning postulates and other types of common knowledge. Exhaustification remains sensitive to the first one, but is adjusted to disregard the latter. Finally, Section 6.4 deals with cases where the sensitivity of exhaustive update to the common world knowledge appears desirable, but which cannot be accounted for anymore after the above mentioned adjustment. I will argue that these cases can be captured by a different mechanism—*relevance* to the decision problem the discourse participants are facing. Thus I will use this as an occasion to introduce another building block of van Rooij and Schulz’ theory of exhaustive interpretation, one that constitutes perhaps the most essential advantage of their proposal over all the previous accounts of exhaustification.

6.3.1 Problem 1: *Three linguists. John and Mary.*

Recall the phenomenon discussed in Chapter 4 (pp. 162–163): there we observed that NPs that denote groups of unequal size do not form a felicitous restatement:

(606) Who snores?

(607) a. # Three linguists. John and Mary.
 b. # John and Mary. Three linguists.

(608) a. # Two linguists. John.
 b. # John. Two linguists.

Such data could be correctly captured by the proposed analysis based on Groenendijk and Stokhof’s (1984) notion of exhaustification (cf. Section 5.4.3). The exhaustive interpretation of the NP denoting the smaller group, e.g. *John and Mary* in (607), would always contradict the interpretation of the other NP. If only John and Mary snore then clearly, only two persons snore, therefore it is not the case that three linguists snore. This result was independent of the order of occurrence of the NPs, since the whole framework was based on static semantics, and classical conjunction was used to connect the exhaustivized meanings of the NPs. However, in the dynamic setting of van Rooij and Schulz (2004b) the order of the NPs plays a crucial role. If the smaller group precedes the bigger one as in the (b) versions of (607) and (608), van Rooij and Schulz’ approach works largely like Groenendijk and Stokhof’s. For instance in (607b), the exhaustive update of the initial information state with *John and Mary* only keeps the worlds in which John, Mary, and no one else snores.¹⁶ In none of these worlds is it the case that three linguists snore, hence the subsequent update with

¹⁶For details, see the analysis of a similar example (582b) in Section 6.2.2, in particular Table 6.4.

<i>linguist</i>	<i>snore</i>							
	$\{j, m, b\}$	$\{j, m\}$	$\{j, b\}$	$\{m, b\}$	$\{j\}$	$\{m\}$	$\{b\}$	\emptyset
$\{j, m, b\}$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	w_{16}	w_{17}	w_{18}
$\{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	w_{26}	w_{27}	w_{28}
$\{j, b\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	w_{36}	w_{37}	w_{38}
$\{m, b\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	w_{46}	w_{47}	w_{48}
$\{j\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	w_{56}	w_{57}	w_{58}
$\{m\}$	w_{61}	w_{62}	w_{63}	w_{64}	w_{65}	w_{66}	w_{67}	w_{68}
$\{b\}$	w_{71}	w_{72}	w_{73}	w_{74}	w_{75}	w_{76}	w_{77}	w_{78}
\emptyset	w_{81}	w_{82}	w_{83}	w_{84}	w_{85}	w_{86}	w_{87}	w_{88}

Table 6.6: The interpretation function F : For each world, the value of $F(\textit{snore})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{linguist})$ in the corresponding row. The green ovals (dashed or solid line) highlight the worlds that belong to the non-exhaustive update of s_0 with *Two linguists snore*, $s_0 \llbracket \textit{Two linguists snore} \rrbracket$. The worlds in the solid line green ovals constitute the exhaustive update with *Two linguists snore* with respect to the question predicate *snore*, $s_0 \llbracket \textit{Two linguists snore} \rrbracket_{exh}^{snore}$. The red ovals mark worlds that belong to the subsequent exhaustive update with *John snores*, $s_0 \llbracket \textit{Two linguists snore} \rrbracket_{exh}^{snore} \llbracket \textit{John snores} \rrbracket_{exh}^{snore}$ (which coincides with the non-exhaustive update).

three linguists leads to an absurd state and the discourse is correctly predicted to be infelicitous.

However, if the bigger group comes first as in (607a) and (608a), the dynamic approach produces no contradiction. This is illustrated for (608a) in Table 6.6.¹⁷ The exhaustive update of the initial information state with *two linguists* contains worlds where two linguists and nobody else snore, cf. (609).

$$(609) s_0 \llbracket \exists x \exists y [x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{snore}(x \oplus y)] \rrbracket_{exh}^{snore} = \{w_{12}, w_{13}, w_{14}, w_{22}, w_{33}, w_{44}\}$$

But in some of these worlds, John is one of the snoring linguists, and obviously, these worlds will constitute the subsequent non-exhaustive update with *John*, cf. (610). However, since the worlds where John is the only snorer

¹⁷Table 6.6 represents a model constructed on the usual assumption that *snore* and *linguist* are atomically distributive, and each possible combination of extensions of these predicates is realised in exactly one world.

are not there any more (they were excluded by the first update), the exhaustification of *John* does not do anything to the information state. We do not find any world in (610) that is $<_{snore}$ -smaller than a world where John and another linguist snore. Hence the exhaustive update $s_0[\exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge snore(x \oplus y)]]_{exh}^{snore} \llbracket snore(j) \rrbracket_{exh}^{snore}$ is identical to (610). In other words, the dynamic approach predicts (608a) to be felicitous and entails that John is one of the two linguists that snore.¹⁸

$$(610) s_0[\exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge snore(x \oplus y)]]_{exh}^{snore} \llbracket snore(j) \rrbracket = \{w_{12}, w_{13}, w_{22}, w_{33}\}$$

Thus under this approach one would need to postulate additional mechanisms in order to deal with the infelicity of (607a) and (608a), although in fact it seems that it has the same cause as in (607b) and (608b). This situation is rather unsatisfactory.

6.3.2 Problem 2: Restatements in non-minimal information states

The second group of problematic data shows that failure of the dynamic exhaustification on restatements is in fact much more general than the case presented in the previous section might suggest. The first problem arises only with restatements whose elements denote groups of unequal size. The second problem may arise with any kind of restatement if it is interpreted in an information state that already contains some of the information the question asks, which is a common situation in discourse.

Let's first consider the exhaustive interpretation of a single answer in such a non-minimal information state. For instance, suppose the conversation (611)–(612) occurs in a situation where the participants' common ground already contains the information that at least Bill snores, that is, in all worlds of the current information state $snore(b)$ is the case. A very simple information state $s = \{w_1, w_2, w_3, w_4\}$ where $F(snore)(w_1) = \{j, m, b\}$, $F(snore)(w_2) = \{j, b\}$, $F(snore)(w_3) = \{m, b\}$ and $F(snore)(w_4) = \{b\}$ gives an illustration.

(611) Who snores?

(612) Mary.

Both the non-exhaustive and the exhaustive update of this state with *Mary snores* is successful, as shown in Figure 6.4. After the non-exhaustive update, we are left with the worlds in which Mary is one of the snorers in addition to Bill, cf. (613). After the exhaustive update (614), Mary is the only snorer in addition to Bill.

$$(613) s[\llbracket snore(m) \rrbracket] = \{w_1, w_3\}$$

$$(614) s[\llbracket snore(m) \rrbracket_{exh}^{snore}] = \{w_3\}$$

At first glance, this is an absolutely plausible result. Indeed it seems that the new information that Mary snores in (612) does not do anything to the old information that Bill snores. Even the exhaustive interpretation of (612) does not entail that Bill does not snore, whereas it does exclude John as a possible

¹⁸This observation can already be found in Zeevat (1994a, pp. 4–5).

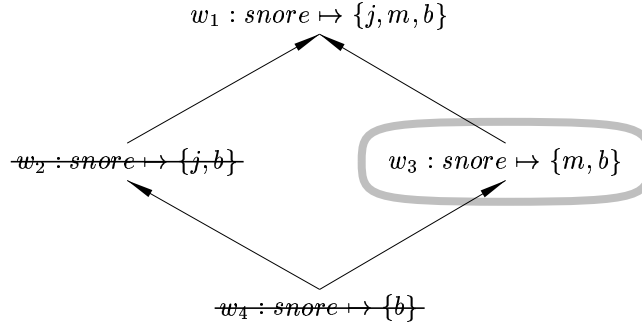


Figure 6.4: The $<_{snore}$ ordering on an information state s that already entails $snore(b)$. The worlds w_2 and w_4 do not survive the non-exhaustive update $s[\![snore(m)]\!]$, since Mary is not among the snorers in those worlds. Of the remaining worlds, w_3 is minimal wrt. $<_{snore}$, and hence constitutes the exhaustive update $s[\![snore(m)]\!]_{exh}^{snore}$.

snorer. And in fact, this is the way circumscription is most commonly used in artificial intelligence. When a new premise is added to the theory, it is circumscribed together with all other premises so if the new premise was consistent with the old ones in the first place, the circumscription (i.e. exhaustification) is consistent, too.

However, as will be shown presently, exhaustification must work differently if it is responsible for the coreference effect in restatements, e.g. (616), where the NPs *a linguist* and *Mary* seem to corefer regardless of whether the common ground already contains the information that Bill snores, or not.

(615) Who snores?

- (616) a. A linguist. Mary.
 b. Mary. A linguist.

Let's consider an information state s where Bill snores in all worlds again, but the extension of the predicate *linguist* is unknown. Table 6.7 represents such a state. Suppose we are processing (616a), i.e. first perform the exhaustive update of s with $\exists x[linguist(x) \wedge snore(x)]$ (a linguist snores). The result of this update very much depends on whether Bill is a linguist or not. If Bill is a linguist then the minimisation with respect to the $<_{snore}$ relation gives us that only Bill snores, e.g. see Figure 6.5. But if Bill is not a linguist then exactly one linguist in addition to Bill snores, cf. Figure 6.6.

$$(617) s[\![\exists x[linguist(x) \wedge snore(x)]\!]_{exh}^{snore} = \{w_{14}, w_{22}, w_{23}, w_{34}, w_{44}, w_{52}, w_{63}, w_{74}\}$$

This result already looks suspect, particularly because of the first entailment: if Bill is a linguist then no one except Bill snores. By contrast, the intuition suggests that if it is known that Bill snores anyway, then the utterer of (616a)

	<i>snore</i> \mapsto			
	$\{j, m, b\}$	$\{j, b\}$	$\{m, b\}$	$\{b\}$
<i>linguist</i> $\mapsto \{j, m, b\}$	w_{11}	w_{12}	w_{13}	w_{14}
<i>linguist</i> $\mapsto \{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}
<i>linguist</i> $\mapsto \{j, b\}$	w_{31}	w_{32}	w_{33}	w_{34}
<i>linguist</i> $\mapsto \{m, b\}$	w_{41}	w_{42}	w_{43}	w_{44}
<i>linguist</i> $\mapsto \{j\}$	w_{51}	w_{52}	w_{53}	w_{54}
<i>linguist</i> $\mapsto \{m\}$	w_{61}	w_{62}	w_{63}	w_{64}
<i>linguist</i> $\mapsto \{b\}$	w_{71}	w_{72}	w_{73}	w_{74}
<i>linguist</i> $\mapsto \emptyset$	w_{81}	w_{82}	w_{83}	w_{84}

Table 6.7: The information state s : For each world, the value of $F(\textit{snore})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{linguist})$ in the corresponding row. Bill (b) snores in all worlds. The green ovals (dashed or solid line) highlight the worlds that belong to the non-exhaustive update of s with A *linguist snores*. The worlds in the solid line green ovals constitute the exhaustive update with A *linguist snores* with respect to the question predicate *snore*. The red ovals mark worlds that belong to the subsequent exhaustive update with $Mary$ *snores* (which coincides with the non-exhaustive update).

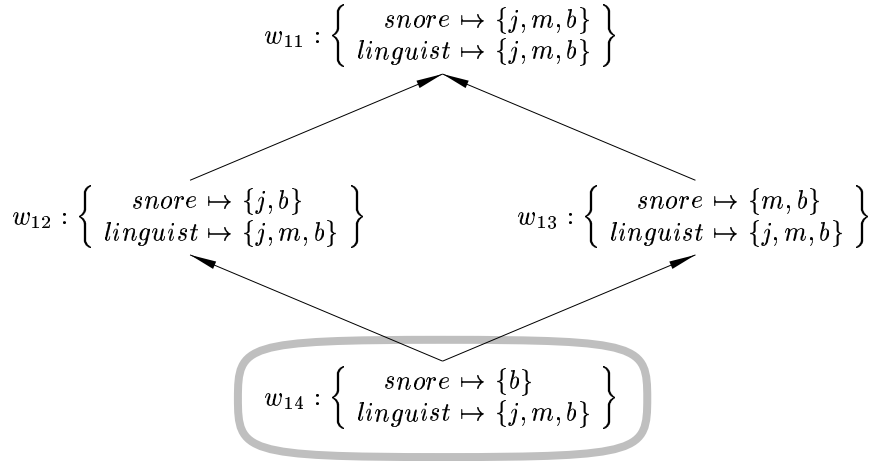


Figure 6.5: The $<_{snore}$ ordering of the worlds $\{w_{11}, w_{12}, w_{13}, w_{14}\}$ where $F(linguist) = \{j, m, b\}$, i.e. Bill is one of the linguists. Since Bill snores in all worlds, in all these worlds is it the case that a linguist snores, i.e. no worlds are excluded by $s[\exists x[linguist(x) \wedge snore(x)]]$. Hence the $<_{snore}$ -smallest world is w_{14} where only Bill snores.

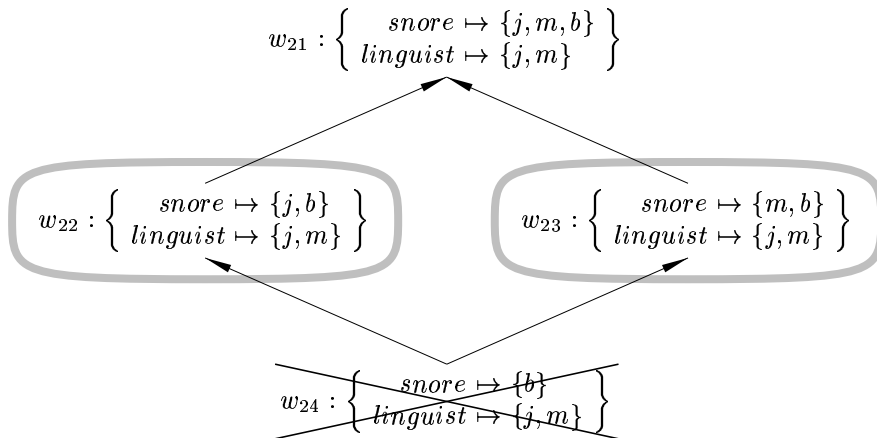


Figure 6.6: The $<_{snore}$ ordering of the worlds $\{w_{21}, w_{22}, w_{23}, w_{24}\}$ where $F(linguist) = \{j, m\}$, i.e. Bill is not a linguist. The non-exhaustive update $s[\exists x[linguist(x) \wedge snore(x)]]$ rules out w_{24} since in that world the set of snorers and the set of linguists do not intersect. Among the remaining worlds, w_{22} and w_{23} are smallest wrt. $<_{snore}$, i.e. in addition to Bill exactly one linguist snores.

	<i>snore</i> \mapsto			
	$\{j, m, b\}$	$\{j, b\}$	$\{m, b\}$	$\{b\}$
<i>linguist</i> $\mapsto \{j, m, b\}$	w_{11}	w_{12}	w_{13}	w_{14}
<i>linguist</i> $\mapsto \{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}
<i>linguist</i> $\mapsto \{j, b\}$	w_{31}	w_{32}	w_{33}	w_{34}
<i>linguist</i> $\mapsto \{m, b\}$	w_{41}	w_{42}	w_{43}	w_{44}
<i>linguist</i> $\mapsto \{j\}$	w_{51}	w_{52}	w_{53}	w_{54}
<i>linguist</i> $\mapsto \{m\}$	w_{61}	w_{62}	w_{63}	w_{64}
<i>linguist</i> $\mapsto \{b\}$	w_{71}	w_{72}	w_{73}	w_{74}
<i>linguist</i> $\mapsto \emptyset$	w_{81}	w_{82}	w_{83}	w_{84}

Table 6.8: The information state s : For each world, the value of $F(\textit{snore})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{linguist})$ in the corresponding row. Bill (b) snores in all worlds. The red ovals (dashed or solid line) highlight the worlds that belong to the non-exhaustive update of s with *Mary snores*. The worlds in the solid line red ovals constitute the exhaustive update with *Mary snores* with respect to the question predicate *snore*. The green ovals mark worlds that belong to the subsequent exhaustive update with *A linguist snores*.

would not mean Bill by answering *a linguist*. Rather the utterer means some linguist in addition to Bill, regardless of whether Bill himself is a linguist or not.

The problem becomes even more evident after the subsequent update with *Mary snores*, cf. (618) and Table 6.7. The worlds where only Bill snores (i.e. worlds where Bill is a linguist) do not survive this update, since Mary does not snore in those worlds. Therefore, in addition to the correct entailment that Mary is a linguist (the coreference effect), (616a) is predicted to entail that Bill is not a linguist, whereas intuitively, this information is not conveyed by this utterance in any way.

$$(618) s[\exists x[\textit{linguist}(x) \wedge \textit{snore}(x)]_{exh}^{snore} [\textit{snore}(m)]_{exh}^{snore}] = \{w_{23}, w_{63}\}$$

The predictions for (616b) are different but also incorrect. In the same information state s , the exhaustive update with the first answer *Mary* works largely like in example (612), i.e. the result entails that apart from Bill, only Mary snores, cf. (619) and Table 6.8.

$$(619) s[\textit{snore}(m)]_{exh}^{snore} = \{w_{13}, w_{23}, w_{33}, w_{43}, w_{53}, w_{63}, w_{73}, w_{83}\}$$

However, the subsequent update with the second answer *a linguist* goes through both in worlds where Mary is a linguist and in worlds where Bill is a linguist, cf. (620) and Table 6.8. In other words, (616b) is predicted to entail that Mary *or* Bill is a linguist, rather than that Mary is a linguist, i.e. the coreference of the NPs in restatement cannot be derived. The problem seems to be the same as in the previous example: since the information that Bill snores is old, the utterance conveying new information *a linguist snores* cannot refer to that old information, i.e. Bill cannot be meant by *a linguist* in (616b).

$$(620) s[\textit{snore}(m)]_{exh}^{snore} [\exists x[\textit{linguist}(x) \wedge \textit{snore}(x)]]_{exh}^{snore} = \{w_{13}, w_{23}, w_{33}, w_{43}, w_{63}, w_{73}\}$$

To summarise, the sensitivity of dynamic exhaustification to old information destroys the inference of correct meanings for restatement discourses. Either we miss the coreference effect as in the last example, or the example in Section 6.3.1; or the discourses turn out to bear weird entailments that they intuitively do not have, as in (616a). A possible solution to these problems is discussed in the next section.

6.3.3 Linguistic competence vs. world knowledge

In the previous two sections it was shown that dynamic exhaustification *à la* van Rooij and Schulz (2004b) gives rise to non-classical dynamic effects, but most of these effects are not wanted if exhaustification is to account for the interpretation of restatements. There are two ways out of this situation: either dynamic exhaustification is the correct approach, but our proposal to use it to deal with restatements is wrong; or the proposal is right, but exhaustification should disregard the information accumulated in the common ground, and in this sense be brought a step back towards the static approach of Groenendijk and Stokhof. In this and the next section I will argue for the latter option.

To begin with, we could ask ourselves what exhaustification should look like for the proposed account of restatement to work properly. Obviously, it should not completely ignore the information contained in the common ground since the meaning postulates are part of that information, and as was shown in Sections 6.1 and 6.2, the interaction of exhaustive interpretation with the meaning postulates is desirable. Therefore a line should be drawn between the meaning postulates (lexical knowledge) and other information (world knowledge) contained in the common ground. Exhaustification should remain sensitive to the former, but disregard the latter. Following the suggestion of Robert van Rooij and Katrin Schulz (p.c.), this idea could be realised as follows:

$$(621) s[A]_{exh}^P = \{w \in s[A] \mid \neg \exists v \in s_0[A][v <_P w]\}$$

The only difference from the original definition (580) is that we look for minimal worlds with respect to the $<_P$ -relation in $s_0[A]$, rather than in $s[A]$, where s_0 is the initial information state—the set of all worlds that conform to the meaning postulates. In this way, the information accumulated in s affects the non-exhaustive update $s[A]$ but not the specific contribution of exhaustification $\min_{<_P}(s_0[A])$, as the reformulation in (622) should make evident (where $\min_{<_P}(X)$ is the subset of X that only contains minimal elements wrt. the

$<_P$ -relation).

$$(622) s[A]_{exh}^P = s[A] \cap \min_{<_P}(s_0[A])$$

This modification thus gets rid of all dynamic effects specific to exhaustification. That is, if the non-exhaustive update $s[A]$ gives rise to classical dynamic effects (for instance, if A contains an epistemic operator like Veltman's *might*), these effects will be preserved by the exhaustive update. However, if $s[A]$ has no dynamic effects (i.e. if $s[A] = s \cap s_0[A]$), then neither does $s[A]_{exh}^P$, i.e. $s[A]_{exh}^P = s \cap s_0[A]_{exh}^P$, as shown in (623).

$$(623) s[A]_{exh}^P = s[A] \cap \min_{<_P}(s_0[A]) = s \cap s_0[A] \cap \min_{<_P}(s_0[A]) = s \cap s_0[A]_{exh}^P$$

Furthermore if neither A_1 nor A_2 have no dynamic effects in the non-exhaustive update, then the successive exhaustive update $s[A_1]_{exh}^P[A_2]_{exh}^P$ is equivalent to updating s independently with A_1 and A_2 , and then intersecting the results, cf. (624). In this case, successive update basically boils down to classical conjunction, which, among other things, is commutative: $s[A_1]_{exh}^P \cap s[A_2]_{exh}^P = s[A_2]_{exh}^P \cap s[A_1]_{exh}^P$.

$$(624) s[A_1]_{exh}^P[A_2]_{exh}^P = s \cap s_0[A_1]_{exh}^P \cap s_0[A_2]_{exh}^P = s[A_1]_{exh}^P \cap s[A_2]_{exh}^P$$

This change reproduces Groenendijk and Stokhof's predictions for the problematic restatements discussed in Sections 6.3.1 and 6.3.2. For example, consider unequal groups once again: (625)–(626). The original definition led to the incorrect prediction that John in (626) is one of the two linguists that snore. The new definition produces a contradiction.

(625) Who snores?

(626) # Two linguists. John.

In the current setting, the propositions *Two linguists snore* and *John snores* have no dynamic effects,¹⁹ so we can use (624) to compute the exhaustive update. Table 6.9 illustrates the result. It is obvious that the intersection of the exhaustive updates of s_0 with *Two linguists snore* (worlds marked with green solid line ovals) and with *John snores* (red solid line) is empty. Thus we are in an absurd state.

$$(627) s_0[\exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge \text{snore}(x \oplus y)]]_{exh}^{snore} \\ \llbracket \text{snore}(j) \rrbracket_{exh}^{snore} = \emptyset$$

Thus the new definition yields a satisfactory result for restatements involving groups of unequal size. As far as interpretation in non-minimal information states is concerned, the result is less convincing, but again equivalent to the one Groenendijk and Stokhof's approach would produce. If the question *Who snores?* receives the answer *Mary* in an information state that already contains the information that Bill snores, the exhaustive interpretation of *Mary* is inconsistent, since now the update $s[\text{snore}(m)]_{exh}^{snore}$ literally entails that Mary is the only person who snores, i.e. not Bill. Hence, any restatement that involves *Mary* as one of its elements will also lead to an absurd state. In other words, the definition of exhaustification proposed here makes restatements work properly, but

¹⁹This is so since the dynamic semantics we assume here does not keep track of discourse referents. The situation is different in the system introduced in Appendix B.

<i>linguist</i>	<i>snore</i>							
	$\{j, m, b\}$	$\{j, m\}$	$\{j, b\}$	$\{m, b\}$	$\{j\}$	$\{m\}$	$\{b\}$	\emptyset
$\{j, m, b\}$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	w_{16}	w_{17}	w_{18}
$\{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	w_{26}	w_{27}	w_{28}
$\{j, b\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	w_{36}	w_{37}	w_{38}
$\{m, b\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	w_{46}	w_{47}	w_{48}
$\{j\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	w_{56}	w_{57}	w_{58}
$\{m\}$	w_{61}	w_{62}	w_{63}	w_{64}	w_{65}	w_{66}	w_{67}	w_{68}
$\{b\}$	w_{71}	w_{72}	w_{73}	w_{74}	w_{75}	w_{76}	w_{77}	w_{78}
\emptyset	w_{81}	w_{82}	w_{83}	w_{84}	w_{85}	w_{86}	w_{87}	w_{88}

Table 6.9: The exhaustive update $s_0[\exists x \exists y[x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{snore}(x \oplus y)]]_{exh}^{snore}[\textit{snore}(j)]_{exh}^{snore}$. The initial information state s_0 : For each world in s_0 , the value of $F(\textit{snore})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{linguist})$ in the corresponding row. Updates: the non-exhaustive update $s_0[\exists x \exists y[x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{snore}(x \oplus y)]]$ (green, dashed or solid line); the exhaustive update $s_0[\exists x \exists y[x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{snore}(x \oplus y)]]_{exh}^{snore}$ (green solid line); the non-exhaustive update $s_0[\textit{snore}(j)]$ (red, dashed or solid line); the exhaustive update $s_0[\textit{snore}(j)]_{exh}^{snore}$ (red solid line); the worlds marked both with green solid line and red dashed line ($w_{12}, w_{13}, w_{22}, w_{33}$) constitute the non-exhaustive update $s_0[\exists x \exists y[x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{snore}(x \oplus y)]]_{exh}^{snore}[\textit{snore}(j)]$; there is no world that is marked with both a green solid and a red solid line, i.e. the intersection of $s_0[\exists x \exists y[x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge \textit{snore}(x \oplus y)]]_{exh}^{snore}$ and $s_0[\textit{snore}(j)]_{exh}^{snore}$ is empty.

loses some good features of dynamic exhaustification discussed in Section 6.3.2.

Two questions arise. First, can the proposed approach be repaired in order to account for the observation that the exhaustification of an answer does not contradict old background information on the question asked (at least in the absence of an overt exhaustification operator like *only*)? This question will receive a positive answer in the next section.

Secondly, now that we have adjusted the definition of exhaustification to our liking, it is natural to ask whether that was just a technical trick, or an independently motivated solution. In other words, why should exhaustive interpretation draw such a sharp distinction between lexical knowledge and world knowledge in the common ground? I suggest a cognitive explanation. The lexical information associated with the items used in the sentence currently being processed is highly activated in the speaker's memory and so cannot be "overlooked". The access to information about the world that is not directly conveyed by the current utterance or the closest context is much more restricted. Thus it makes a crucial difference whether two answers to the same question are indeed uttered next to each other as in (629), or the information that at least Bill snores forms part of background knowledge that is not currently at issue. In (629) the exhaustification of *Mary snores* indeed contradicts the information that Bill snores, in the second case, it does not.

(628) Who snores?

(629) # At least Bill. Mary.

In the next section, this opposition will be modelled using the notion of *relevance*. It should be noted though that the distinction between lexical and world knowledge also plays an important role in coherence-based frameworks of discourse semantics. For instance, Asher and Lascarides (2003) argue that during the inference of a discourse relation, the agent has limited access to world knowledge, whereas the lexicon is readily available. The whole apparatus of glue logic in SDRT (as distinct from the domain level logic) serves the purpose of making this distinction. By making exhaustification sensitive to the meaning postulates but insensitive to other information in the common ground, we carry out the same idea. The inference of coreference relations in restatements is now dependent on much more limited resources than with the original version of dynamic exhaustification.

6.4 Relevance

The previous section revealed some problems with the way dynamic exhaustification deals with information accumulated in the common ground. It was shown that if exhaustive interpretation circumscribes the whole stock of accumulated information, both restatements and single answers of certain types get counterintuitive exhaustive interpretations. Moreover, if exhaustive update is something humans do during discourse interpretation, it is highly unlikely that this involves constant access to world knowledge, as it is a costly operation in terms of processing, much more costly than e.g. lexical access. Therefore I argued for a more traditional notion of exhaustification that disregards world knowledge and only circumscribes the information directly conveyed by the sen-

tence and the associated lexical information. However, this approach leaves us with a major problem (which the information-sensitive notion of exhaustivity seemed to have a solution to): it is unclear how the accumulation of information in the course of exhaustive update is possible at all. If exhaustification does not preserve the information accumulated in the common ground, exhaustive interpretations assigned to sentences in discourse are so strong that we run into contradictions much sooner than we expect. The simplest example is the following question-answer pair that was already discussed in the previous section:

(630) Who snores?

(631) Mary.

If this dialogue takes place in a situation where it is known that Bill snores, (631) must be contradictory, since its exhaustive interpretation entails that Bill does not snore. However, intuitively, (631) simply says that Mary is the only person who snores in addition to Bill.

In this section I will discuss an alternative solution to this problem which is based on the notion of *relevance*. The idea is old and very simple: the *only*-implicature that the exhaustive interpretation of a proposition ϕ gives rise to only excludes *relevant* alternatives to ϕ and implies nothing with respect to the irrelevant ones. Since known information is normally irrelevant, it is thus not affected by exhaustification. In general, the role of relevance in exhaustive interpretation is much wider than just to account for cases of domain restriction such as the above example, see e.g. van Rooij (2003a) for discussion. However, in this section I will primarily concentrate on domain restriction, as this is the function of relevance that is most important for a correct account of information accumulation in discourse and the analysis of restatements in non-minimal information states.

Although *relevance* is an old concept, only recently in van Rooij's work (van Rooij, 2003a,b; van Rooij, 2004) has it received a formal treatment that gives it predictive power and makes it applicable to a wide variety of linguistic phenomena. Thus the first task undertaken in this section will be to test whether van Rooij's theory of relevance provides the right mechanism of domain restriction and makes correct predictions wrt. the exhaustive interpretation of single answers and restatements in non-minimal information states. The main concepts of van Rooij's theory will be introduced in the first three sections in a step by step fashion. These concepts include: (a) the *relevant question* induced by the agents' current *decision problem* (Section 6.4.1); (b) a number of *relevance order* relations that order objects of different types (propositions, sets of individuals, worlds) according to their relevance (Section 6.4.2); and finally (c) the notion of relevance-driven *optimal interpretation* (Section 6.4.3). According to van Rooij, the way relevance affects exhaustive interpretation of answers is primarily through the relevance orderings,²⁰ and optimal interpretation presents an alternative mechanism for doing largely the same thing. However, I will argue that the approaches are in fact not equivalent. In Section 6.4.2 it will be shown that in contexts that give rise to a domain restriction, exhaustive interpretation based on the notion of relevance order alone does not provide correct

²⁰Roughly speaking, exhaustification only excludes alternatives that are more relevant than the selected one on the relevance scale.

results for indefinite descriptions. To fix this problem, in Section 6.4.3, I will introduce a modification of van Rooij’s proposal that will make crucial use of the notion of optimal interpretation.²¹ After these adjustments, in Section 6.4.4 I will discuss some general consequences of integrating the notion of relevance in a theory of restatement, and finally in Section 6.4.5, the new approach will be applied to cases like (630)–(631) above where some information that pertains to the question asked is already entailed by the current information state.

6.4.1 The relevant question

The first question to ask ourselves is what is our intuitive notion of relevance. What does it mean to care or not to care about something? A possible way of looking at it is to take some information to be relevant if it affects your decision to act in a particular way. This idea is implemented in van Rooij’s formal treatment of relevance based on statistical decision theory (van Rooy, 2003a). It is assumed that an agent is facing a *decision problem*: he or she considers taking one of a set of alternative actions whose desirability or usefulness differs in different possible worlds. For example, suppose I am considering whether to take an umbrella or to leave it at home. I do not know whether it will rain, i.e. my information state will contain possible worlds in which it will rain and worlds where it will not. Obviously, in rainy worlds, taking an umbrella is a more desirable action than not taking it; and perhaps *vice versa* in worlds with good weather. The “desirability” of actions in possible worlds is modelled by a *utility function* that assigns a numerical value to an action relative to a world. I will not present the related formal apparatus here (see van Rooy, 2003a, for details), and will gloss over the details on the way to the notion that will be most useful for our further discussion.

Given a decision problem, possible worlds in W can be classified according to the most useful action in those worlds, i.e. the action with the highest utility.²² Assuming that there is exactly one most useful action in each world, this “classification” will give rise to a *partition* of W .²³ The resulting partition can be thought of as the question the agent is currently most interested in. If the agent knew which cell of this partition is true, (s)he would have no doubts as to which action to choose, since only one action would dominate all the others in terms of utility. Henceforth, I will refer to this partition as the *relevant question*.

²¹It is not a coincidence that indefinite descriptions receive so much attention, both in the previous section and in this one. Recall that the ultimate purpose of the present investigation is to give a plausible account of sentential restatement and elaboration, which involve coreference relations between events. But events are normally identified by description, and almost never by name (hardly any events have proper names). Thus the coreference relations between events must be inferred from the exhaustive interpretation of event descriptions, which work largely like indefinite descriptions of individuals (cf. the discussion in Chapter 5, Section 5.3.2). Therefore, an adequate exhaustive interpretation for indefinite descriptions of individuals has to be provided first.

²²Strictly speaking, the relevant notion here is *expected utility*, i.e. utility factorised by the probability of the respective worlds. However, if worlds are assumed to have equal probabilities, the distinction between *utility* and *expected utility* is irrelevant.

²³If there is more than one most useful action in some world, the resulting “classification” of worlds will not be a partition, i.e. some sets of worlds may intersect. This is a typical situation for decision problems that give rise to *mention-some* questions (cf. van Rooy, 2003a; van Rooij and Schulz, 2004b). Such cases will be ignored henceforth, though see Section 6.7.1 for some remarks on the mention-some case.

Thus the relevant question turns out to be the same type of object as the intensional interpretation of an interrogative sentence in partition-based theories of interrogative semantics (e.g. Groenendijk and Stokhof, 1984). However, it is crucial to draw a sharp distinction between these two notions. Interrogative sentences are, in the first place, sentences in a particular natural language. By contrast, the relevant question in the above sense is not part of language. It is provided by an external system—the system of the agent’s domain-level goals—and can be thought of as a “projection” of the domain-level goals at the level of discourse goals. The relevant question thus has no *a priori* relation to an interpretation of any natural language interrogative. (In fact, it might not even be expressible in natural language at all.)

Let’s consider an example that is not so simple as to be easily confused with a conventional interpretation of a (reasonably short) interrogative sentence. Suppose Sue has a suspicion that someone smokes regularly in the hallway of the department building, which is a non-smoking area. And suppose, Sue is that kind of unpleasant character who would immediately complain to your boss once she finds out that you are doing some mischief. However, before Sue can reasonably complain, she needs to find out (a) the identity of the person, or persons, that smoke in the hallway; and (b) to which departments those persons belong. For instance, if Sue finds out that John smokes in the hallway and that he is a linguist, then she would go to the head of the linguistics department and say that John smokes in the hallway. And if it turns out that both John and Mary smoke, where John is a mathematician and Mary is a linguist, then Sue would have to visit the heads of both departments to tell on their respective employees. Suppose, however, that even Sue has a soft spot to her. An hour ago she met a charming guy called Bill, who she perhaps would not tell on, no matter in which department he is and no matter if it is in fact him who smokes in the hallway. (In other words, Bill is *irrelevant* as a possible culprit.)

This situation can be modelled as a decision problem Sue is facing. Suppose the domain of “possible smokers” contains just three individuals John, Mary and Bill: $\{j, m, b\}$. Let’s assume that there are just two departments, linguistics and mathematics, and that each of John, Mary and Bill is either a linguist or a mathematician (not both). In this setting, there are nine alternative actions that would make sense for Sue, listed in (632). Obviously, going to the head of the linguistics department and telling him or her that John and Mary smoke in the hallway (632a) would make most sense (have the highest utility) in worlds where John and Mary are employees of the linguistics department and indeed both of them smoke in the hallway. But in worlds where, for instance, Bill is the only smoker, the best choice for Sue is to do nothing (632i). The partition of the set of possible worlds W according to the most useful actions in those worlds is presented in Table 6.10 (worlds belonging to different cells of the partition are highlighted with different colours).

- (632) a. Tell the head of the linguistics department that John and Mary smoke;
 b. Tell the head of the linguistics department that John smokes;
 c. Tell the head of the linguistics department that Mary smokes;
 d. Tell the head of the mathematics department that John and Mary smoke;
 e. Tell the head of the mathematics department that John smokes;
 f. Tell the head of the mathematics department that Mary smokes;
 g. Tell the head of the linguistics department that John smokes, and tell the head of the mathematics department that Mary smokes;
 h. Tell the head of the linguistics department that Mary smokes, and tell the head of the mathematics department that John smokes;
 i. Do nothing.

Thus the partition in Table 6.10 is Sue's current *relevant question*. Notice that it is defined completely in terms of Sue's goals and interests, and is independent of whether it is ever to be expressed by a natural language interrogative. Of course, this kind of question can be expressed in natural language, but its unambiguous expression would probably be rather complex, e.g. (633).

- (633) Who smokes in the hallway apart from Bill, and if they do from which department are they?

It seems that speakers usually prefer to use simpler interrogative sentences (perhaps more than one) rather than a single complex one, to express their epistemic interests. I will skip the discussion why this might be the case and what determines the particular choice of question(s) asked instead, and concentrate on investigating the case where the agent simply asks *Who smokes in the hallway?* having in mind the decision problem and the relevant question described above.

Two remarks should be made regarding the given decision problem and the related relevant question. First, the agent might in fact get away by just asking *Who smokes in the hallway?* and nothing else to get all the information she needs. If her communication partner recognises her intentions, and in particular, the fact that she is not only interested in the smoker's names but also in the departments they belong to, he might immediately give two answers to her question: one listing the smokers by name, and one by department, e.g. (635). If Sue learns both that Mary is the only person who smokes in the hallway and that some linguist is the only person who does, she will be able to pick a single cell in her relevant question partition (the cell highlighted green in Table 6.10), and hence have no doubts as to which action from (632) to perform (namely (632c)). But notably, (635) is nothing else but a restatement of the type we are interested in (cf. (616) in Section 6.3.2). In other words, the decision problem and the relevant question described above are an example of a context in which both components of a restatement are independently relevant.²⁴

- (634) Who smokes in the hallway?

²⁴The independent relevance of each component of a restatement in the given context plays an important role, for instance, in the felicity of restatements involving quantified expressions, cf. the discussion in Chapter 4, pp. 149–150, although an account of that particular case would require incorporating the effort factor.

$smoke \mapsto$	$\{j, m, b\}$	$\{j, m\}$	$\{j, b\}$	$\{j\}$	$\{m, b\}$	$\{m\}$	$\{b\}$	\emptyset
$ling \mapsto \{j, m, b\}$ $math \mapsto \emptyset$								
$ling \mapsto \{j, m\}$ $math \mapsto \{b\}$								
$ling \mapsto \{j, b\}$ $math \mapsto \{m\}$								
$ling \mapsto \{j\}$ $math \mapsto \{m, b\}$								
$ling \mapsto \{m, b\}$ $math \mapsto \{j\}$								
$ling \mapsto \{m\}$ $math \mapsto \{j, b\}$								
$ling \mapsto \{b\}$ $math \mapsto \{j, m\}$								
$ling \mapsto \emptyset$ $math \mapsto \{j, m, b\}$								

Table 6.10: The relevant question: Partition of W induced by the agent's desire to know for all individuals except Bill, whether they smoke or not, and if they do, to which department they belong. Worlds belonging to different cells of the partition are highlighted with different colours. For instance, the worlds $\{w_{11}, w_{12}, w_{21}, w_{22}\}$ (pink) constitute the partition cell in which Sue's most useful action is to tell the head of the linguistics department that John and Mary smoke (632a. Legend: **Pink:** apart from Bill, John and Mary smoke and are both linguists; **Brown:** apart from Bill, John (a linguist) and Mary (a mathematician) smoke; **Light blue:** apart from Bill, John (a mathematician) and Mary (a linguist) smoke; **Magenta:** apart from Bill, John and Mary smoke and are both mathematicians; **Dark blue:** apart from Bill, only John smokes and he is a linguist; **Yellow:** apart from Bill, only John smokes and he is a mathematician; **Green:** apart from Bill, only Mary smokes and she is a linguist; **Red:** apart from Bill, only Mary smokes and she is a mathematician; **Grey:** no one smokes apart from Bill.

(635) Mary. A linguist.

Second, if Sue’s communication partner also recognises that Bill is irrelevant for Sue as a possible person she might tell on, then he can spare the effort of naming Bill, even if Bill is in fact one of the smokers. In this case, the list provided by the answerer does not imply anything wrt. Bill, whereas it is understood as exclusive wrt. to all other persons not named explicitly. In other words, the given decision problem and the corresponding relevant question model a context in which the domain of exhaustification of the answer is *restricted* to a set of persons that does not contain Bill. Relevance-based domain restriction is the mechanism that will account for the observation that exhaustive interpretation does not contradict known information. Therefore, I will next discuss van Rooij’s (2003a; 2004)/van Rooij and Schulz’ (2004b) proposal as to how a particular domain restriction can be derived from a given relevant question. I will first concentrate on the exhaustive interpretation of single answers, and later return to restatements.

6.4.2 Relevance orderings

Recall once again our current definition of exhaustification (621), repeated below (in two alternative notations). So far the specific contribution of exhaustivity has been taken to minimise the set of worlds $s_0[[A]]$ with respect to the $<_P$ relation that orders worlds along the inclusion relation between the extensions of the question predicate P in those worlds, cf. (638).²⁵ This minimisation guarantees that the exhaustive interpretation of a list is the minimal set consistent with this list, i.e. the individuals named explicitly and no one else.

$$(636) s[[A]]_{exh}^P = \{w \in s[[A]] \mid \neg \exists v \in s_0[[A]][v <_P w]\}$$

$$(637) s[[A]]_{exh}^P = s[[A]] \cap \min_{<_P}(s_0[[A]])$$

$$(638) w_1 <_P w_2 \text{ iff}$$

- a. $F(P)(w_1) \subset F(P)(w_2)$, and
- b. for all $R \in \mathcal{X}$, $F(R)(w_1) = F(R)(w_2)$.

According to van Rooij and Schulz, the influence of the relevant question on exhaustive interpretation consists primarily in affecting this ordering. In the case of a relevant question that gives rise to a domain restriction as the one discussed above, worlds that differ only in whether the irrelevant individual (Bill) has property P become incomparable wrt. $<_P$ (or P -equal, $=_P$). As a result, the $<_P$ -ordering looks as shown in Figure 6.7 (rather than e.g. Figure 6.1 in Section 6.1).

Formally, this result is achieved as follows. The $<_P$ ordering on worlds is made sensitive to context by replacing set theoretical (proper) inclusion \subset in its definition by a relevance-based order $<_P$, cf. (639).²⁶ One set of individuals is said to be less relevant than another with respect to a predicate P ($<_P$) if the proposition that at least all the individuals of the first set have property P

²⁵For discussion on the constitution of the set \mathcal{X} that restricts the set of predicates taken into account by the *ceteris paribus* condition in the definition of $<_P$, see pp. 217–218 in Section 6.1.

²⁶The same notation “ $<_P$ ” is used for two different order relations here, one operating on worlds ($w_1 <_P w_2$), and the other on sets of individuals (e.g. $\{j, b\} <_P \{j, m, b\}$). It should always be evident from the context which relation is meant in each case.

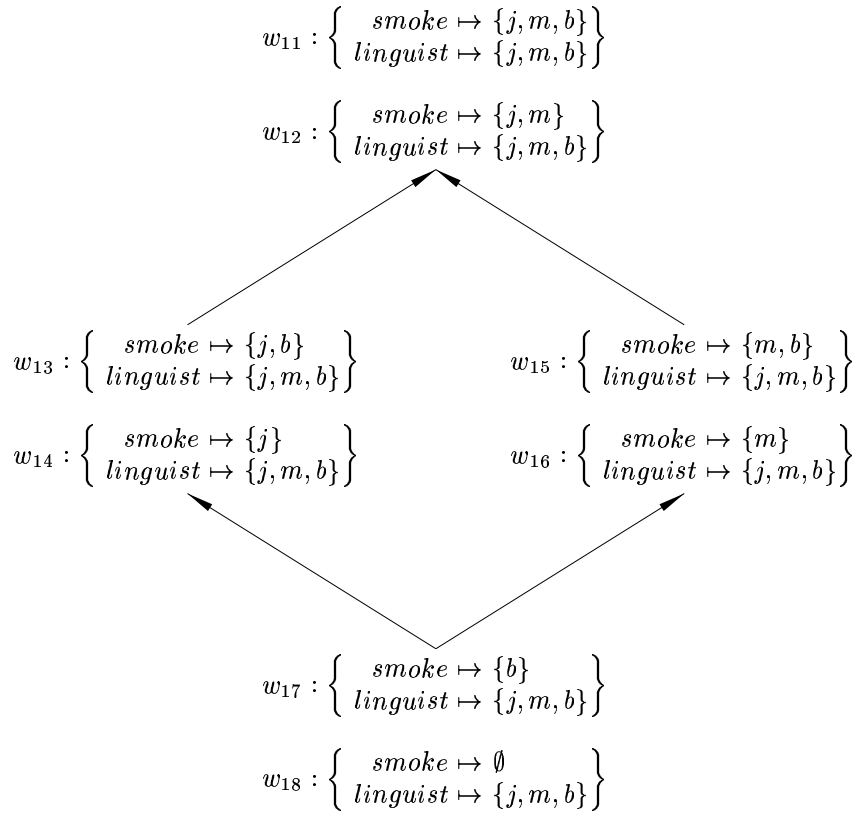


Figure 6.7: The $<_{\textit{smoke}}$ -ordering on worlds $\{w_{11}, \dots, w_{18}\}$ induced by the relevant question illustrated in Table 6.10 (the extension of the predicate *mathematician* is ignored since it is determined completely by the extension of *linguist*). Since it is irrelevant to the current decision problem whether Bill smokes or not, worlds that differ only in whether Bill is in the extension of *smoke* are P -equal. For example, $w_{12} =_P w_{11}$ rather than $w_{12} <_P w_{11}$, since $F(\textit{smoke})(w_{11}) = \{j, m, b\}$ and $F(\textit{smoke})(w_{12}) = \{j, m\}$, i.e. the inclusion of b is the only difference.

is less relevant than the same proposition about the second set, propositions being understood as sets of possible worlds, cf. (640). ($=_P$ on worlds and sets of individuals is defined analogously.)

- (639) $w_1 <_P w_2$ iff
 a. $F(P)(w_1) <_P F(P)(w_2)$, and
 b. for all $R \in \mathcal{X}$, $F(R)(w_1) = F(R)(w_2)$.

- (640) Suppose X and Y are sets of individuals ($X, Y \subseteq D$):
 $X <_P Y$ iff $\{w | X \subseteq F(P)(w)\} <_{rel} \{w | Y \subseteq F(P)(w)\}$

The relevance of a proposition in turn can be measured by how much it helps in answering the relevant question, i.e. selecting exactly one cell in the relevant question partition. So relevance is reduced to Groenendijk and Stokhof's notion of informativity (Groenendijk and Stokhof, 1997, p. 1095).²⁷ Thus, informally, proposition p is less relevant than proposition p' , if p "deletes" fewer cells of the relevant question partition Q than p' does, or to be more precise, $\{q \in Q | p \subseteq \bar{q}\} \subset \{q \in Q | p' \subseteq \bar{q}\}$, cf. (641).

- (641) Suppose p and p' are propositions (sets of possible worlds):
 $p <_{rel} p'$ iff $\{q \in Q | p \subseteq \bar{q}\} \subset \{q \in Q | p' \subseteq \bar{q}\}$

In this way the exhaustive interpretation of a sentence is ultimately made sensitive to the agent's decision problem in a number of steps: (a) the decision problem determines the relevant question Q ; (b) the relevant question Q in turn determines the relevance ordering $<_{rel}$ on propositions; (c) $<_{rel}$ and the choice of the question predicate P determine the relevance ordering $<_P$ on sets of individuals; (d) the relevance ordering $<_P$ on sets of individuals constrains the relevance ordering $<_P$ on worlds; and finally, (e) $<_P$ -order on worlds affects the exhaustive interpretation.

Perhaps this rather complex architecture needs illustration. To begin with, let's see what the relevance order $<_{smoke}$ on sets of individuals looks like for the decision problem faced by Sue in the example discussed earlier, cf. Table 6.10. For instance, how are the sets $\{j, m, b\}$ and $\{j, m\}$ related in terms of $<_{smoke}$ or $=_{smoke}$? To find this out, we first need to determine the sets of worlds in which the sets $\{j, m, b\}$ and $\{j, m\}$ form a subset of the extension of *smoke* (according to the definition in (640)). Assuming the model presented in Table 6.10, these sets of worlds are as shown in (642): (642a) corresponds to the proposition that (at least) John, Mary and Bill smoke, whereas (642b) corresponds to the proposition that at least John and Mary smoke.

- (642) a. $\{w | \{j, m, b\} \subseteq F(smoke)(w)\} = \{w_{11}, w_{21}, w_{31}, w_{41}, w_{51}, w_{61}, w_{71}, w_{81}\}$
 b. $\{w | \{j, m\} \subseteq F(smoke)(w)\} = \{w_{11}, w_{21}, w_{31}, w_{41}, w_{51}, w_{61}, w_{71}, w_{81}, w_{12}, w_{22}, w_{32}, w_{42}, w_{52}, w_{62}, w_{72}, w_{82}\}$

Although the first proposition excludes more worlds than the second one, both of them select/exclude the same cells in the relevant question partition. As is evident from Table 6.10, $\{w | \{j, m, b\} \subseteq F(smoke)(w)\}$ selects the pink, the brown, the light blue and the magenta cells of the partition, and excludes

²⁷ Van Rooij also discusses other ways of defining relevance of a proposition that are more closely related to the numerical notion of utility of actions (see e.g. van Rooij, 2003a). I will ignore these options here, as the notion of relevance based on informativity will be sufficient for the present purposes.

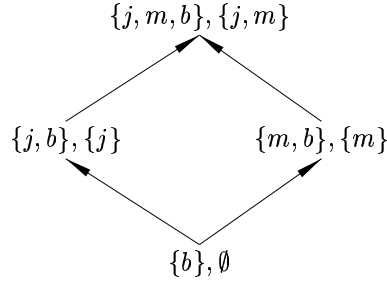


Figure 6.8: The $<_{smoke}$ -ordering on subsets of D induced by the relevant question illustrated in Table 6.10. Since it is irrelevant to the current decision problem whether Bill smokes or not, sets that differ only in whether they include Bill are *smoke*-equal. For example, $\{j, m\} =_P \{j, m, b\}$ rather than $\{j, m\} <_P \{j, m, b\}$.

the dark blue, the yellow, the red, the green and the grey ones, cf. definition (641). The same holds for $\{w|\{j, m\} \subseteq F(smoke)(w)\}$. Hence the propositions $\{w|\{j, m, b\} \subseteq F(smoke)(w)\}$ and $\{w|\{j, m\} \subseteq F(smoke)(w)\}$ are *equally relevant* with respect to the current relevant question, cf. (643), and accordingly, the sets $\{j, m, b\}$ and $\{j, m\}$ are equally relevant with respect to the relevant question and the predicate *smoke*. Thus as expected, two sets that only differ in whether they include or exclude Bill turn out to be *smoke*-equal, since Bill's smoking is irrelevant.

$$(643) \{w|\{j, m, b\} \subseteq F(smoke)(w)\} =_{rel} \{w|\{j, m\} \subseteq F(smoke)(w)\}$$

$$(644) \{j, m, b\} =_{smoke} \{j, m\}$$

Let's now compare $\{j, m, b\}$ with $\{j, b\}$ that differs in a "relevant individual" Mary. Applying the same definitions to $\{j, b\}$, we find that the proposition that at least John and Bill smoke contains the worlds listed in (645), cf. Table 6.10. But obviously, $\{w|\{j, b\} \subseteq F(smoke)(w)\}$ does not exclude the same cells of Q as $\{w|\{j, m, b\} \subseteq F(smoke)(w)\}$. The cells excluded by $\{w|\{j, b\} \subseteq F(smoke)(w)\}$ are the green, the red and the grey ones, which is a proper subset of the cells excluded by $\{w|\{j, m, b\} \subseteq F(smoke)(w)\}$, cf. above. Hence the proposition that (at least) John and Bill smoke is less relevant to Q than the proposition that John, Mary and Bill smoke, cf. (646). Hence $\{j, b\} <_{smoke} \{j, m, b\}$.

$$(645) \{w|\{j, b\} \subseteq F(smoke)(w)\} = \{w_{11}, w_{21}, w_{31}, w_{41}, w_{51}, w_{61}, w_{71}, w_{81}, \\ w_{13}, w_{23}, w_{33}, w_{43}, w_{53}, w_{63}, w_{73}, w_{83}\}$$

$$(646) \{w|\{j, b\} \subseteq F(smoke)(w)\} <_{rel} \{w|\{j, m, b\} \subseteq F(smoke)(w)\}$$

$$(647) \{j, b\} <_{smoke} \{j, m, b\}$$

If we continue the same computations for other subsets of the domain of individuals D , we find that the $<_{smoke}$ -relation orders these sets as shown in Figure 6.8. It is easy to see that by definition (639), the corresponding $<_{smoke}$ -ordering on worlds will have the expected structure, cf. Figure 6.7.

According to van Rooij, we could stop here and use the relevance order $<_P$ on sets of individuals directly in the definition of the relevance order $<_P$ on worlds, as the definition (639) has it. And indeed, this approach already works correctly for proper name answers, such as (649). Among the worlds where Mary is one of the smokers (circled red in Table 6.11), the minimal ones with respect to the relevance-based $<_{smoke}$ -order (cf. Figure 6.9) include both the worlds where only Mary smokes and the worlds where only Mary and Bill smoke (solid line red circles in Table 6.11). Thus the exhaustive interpretation of *Mary smokes* as an answer to the question *Who smokes?* entails that none of the *relevant* individuals smoke except Mary, e.g. John does not, however, nothing is implied about Bill.

(648) Who smokes in the hallway?

(649) Mary.

However, as far as indefinite NP answers such as (651) are concerned, this approach leaves us with largely the same problems as those observed in Section 6.3.2. The non-exhaustive interpretation of *A linguist smokes* (circled green in Table 6.11) will include worlds where Bill is both a linguist and the only smoker, e.g. w_{17} in Table 6.11. Such worlds will always turn out to be minimal with respect to the $<_{smoke}$ -relation, cf. Figure 6.10, so it is predicted that the answer *a linguist*, on its exhaustive interpretation, may refer to Bill, even though Bill is irrelevant.

(650) Who smokes in the hallway?

(651) A linguist.

It seems that in order to solve this problem, what is needed is some way to exclude from the non-exhaustive interpretation of the answer those worlds where the question predicate only applies to irrelevant individuals. A possible solution is provided by the mechanism of relevance-based *optimal interpretation*, which is considered next.

6.4.3 Optimal interpretation

Another possible way in which the interpretation of utterances can be made sensitive to relevance is by making the interpretation of the question predicate dependent on the relevant question and the related relevance ordering. Notice that all the discussion so far was based on a standard assumption that logical forms of sentences are interpreted in a model, and in particular, wrt. an interpretation function F that maps predicate symbols of the representation language to their intensional meanings—functions from worlds to sets of tuples of individuals. Thus if P is a one-place predicate, $F(P)(w)$ corresponds to the set of individuals that have property P in world w . Henceforth I will refer to F as the *conventional* interpretation function. Conventional interpretation is invariant with respect to context. The corresponding context sensitive notion is that of *optimal interpretation*. The idea of optimisation in the interpretation of natural language has been developing rapidly in the recent years in the framework of optimality-theoretic semantics and pragmatics (Blutner, 2000; Blutner and Zeevat, 2003). In this section I will make use of the implementation of

	<i>smoke</i> \mapsto							
	$\{j, m, b\}$	$\{j, m\}$	$\{j, b\}$	$\{j\}$	$\{m, b\}$	$\{m\}$	$\{b\}$	\emptyset
<i>linguist</i> $\mapsto \{j, m, b\}$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	w_{16}	w_{17}	w_{18}
<i>linguist</i> $\mapsto \{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	w_{26}	w_{27}	w_{28}
<i>linguist</i> $\mapsto \{j, b\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	w_{36}	w_{37}	w_{38}
<i>linguist</i> $\mapsto \{j\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	w_{46}	w_{47}	w_{48}
<i>linguist</i> $\mapsto \{m, b\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	w_{56}	w_{57}	w_{58}
<i>linguist</i> $\mapsto \{m\}$	w_{61}	w_{62}	w_{63}	w_{64}	w_{65}	w_{66}	w_{67}	w_{68}
<i>linguist</i> $\mapsto \{b\}$	w_{71}	w_{72}	w_{73}	w_{74}	w_{75}	w_{76}	w_{77}	w_{78}
<i>linguist</i> $\mapsto \emptyset$	w_{81}	w_{82}	w_{83}	w_{84}	w_{85}	w_{86}	w_{87}	w_{88}

Table 6.11: The exhaustive update of the initial information state s_0 with the propositions *Mary smokes* and *A linguist smokes* with respect to the question *Who smokes?* on the assumption that Bill is irrelevant. The interpretation function F : For each world in s_0 , the value of $F(\textit{smoke})$ in that world is given in the heading of the corresponding column, and the value of $F(\textit{linguist})$ in the corresponding row. Updates: the non-exhaustive update $s_0[\textit{smoke}(m)]$ (red, dashed or solid line); the exhaustive update $s_0[\textit{smoke}(m)]_{exh}^{smoke}$ (red solid line); the non-exhaustive update $s_0[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]$ (green, dashed or solid line); the exhaustive update $s_0[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]_{exh}^{smoke}$ (green solid line). The exhaustive update of s_0 with *a linguist smokes* entails that if Bill is a linguist then he is the only smoker.

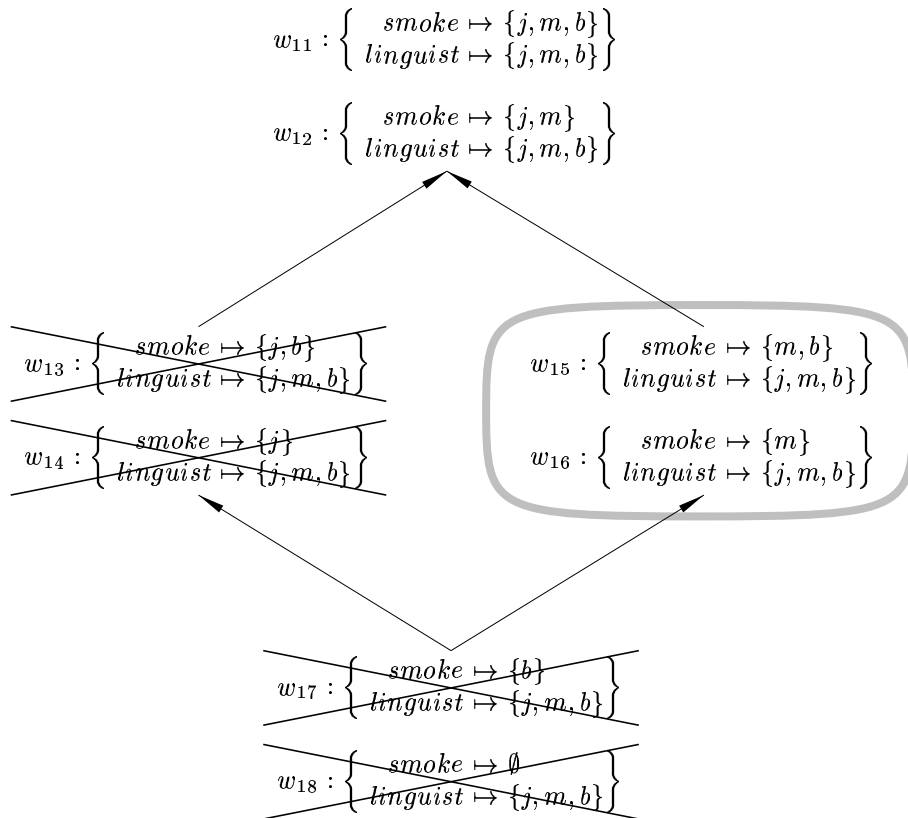


Figure 6.9: The relevance ordering $<_{smoke}$ of the worlds $\{w_{11}, w_{12}, w_{13}, w_{14}, w_{15}, w_{16}, w_{17}, w_{18}\}$ where $F(linguist) = \{j, m, b\}$. Since Bill is irrelevant, worlds that only differ in whether Bill smokes or not are *smoke*-equal, e.g. $w_{16} =_{smoke} w_{15}$, rather than $w_{16} <_{smoke} w_{15}$ (cf. w_6 and w_4 in Figure 6.1, where Bill is relevant). The crossed out worlds $w_{13}, w_{14}, w_{17}, w_{18}$ are excluded from the non-exhaustive interpretation of *Mary smokes*, $s_0[[smoke(m)]]$, since m is not in the extension of *smoke* in those worlds. Among the remaining worlds, both w_{15} and w_{16} are minimal wrt. the relevance ordering $<_{smoke}$, since neither of them is less relevant wrt. *smoke* than the other.

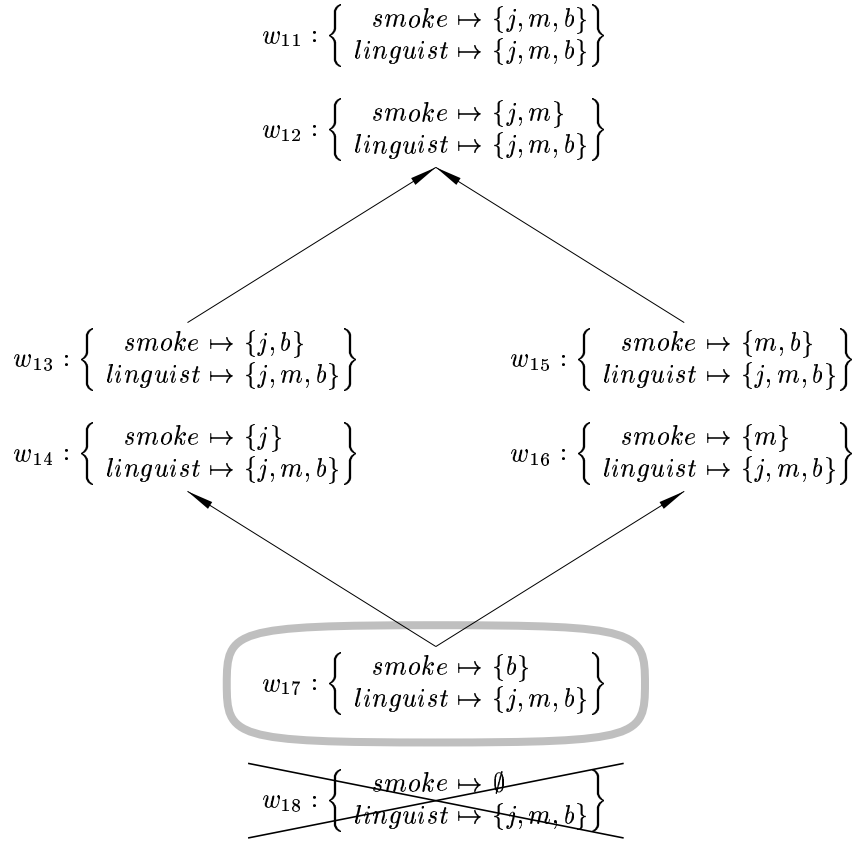


Figure 6.10: The relevance ordering $<_{smoke}$ of the worlds $\{w_{11}, w_{12}, w_{13}, w_{14}, w_{15}, w_{16}, w_{17}, w_{18}\}$ where $F(\textit{linguist}) = \{j, m, b\}$, i.e. Bill is one of the linguists. Since Bill is irrelevant, worlds that only differ in whether Bill smokes or not are *smoke*-equal, e.g. $w_{18} =_{smoke} w_{17}$, rather than $w_{18} <_{smoke} w_{17}$. Worlds that are not crossed out belong to the non-exhaustive interpretation of *A linguist smokes*: $s_0[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]$. Since the intersection of $F(\textit{smoke})(w_{17})$ and $F(\textit{linguist})(w_{17})$ is non-empty (and contains Bill), the proposition that a linguist smokes is also true in w_{17} . But w_{17} is minimal wrt. $<_{smoke}$ among the worlds in $s_0[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]$, therefore w_{17} will be included in the exhaustive interpretation of *A linguist smokes*, although the proposition is verified by an irrelevant individual.

this idea developed by van Rooij (van Rooy, 2003a,b; van Rooij and Schulz, 2004b; van Rooij, 2004), with particular reference to the version presented in van Rooij (2004) and van Rooy (2003b).²⁸ Roughly speaking, optimal interpretation is viewed in this approach as the same type of object as the conventional interpretation function, but it may deviate from conventional interpretation on demands of relevance.

Van Rooij’s (2004) definition of optimal interpretation is given in (652); (653) is just a reformulation of (652).

$$(652) O(P)(w) = \{X \subseteq F(P)(w) \mid \neg \exists Y \subseteq F(P)(w)[Y >_P X] \wedge \neg \exists Z \subset X[Z =_P X]\}$$

$$(653) O(P)(w) = \min_C(\max_{<_P}(\mathcal{P}(F(P)(w))))$$

According to this definition, the optimal interpretation of predicate P in world w must be a subset of its conventional interpretation in that world, $O(P)(w) \in \mathcal{P}(F(P)(w))$, cf. constraint $X \subseteq F(P)(w)$ in (652). This constraint makes sure that the optimal interpretation of a predicate can be more specific than its conventional interpretation, but not more general or just completely different. For instance, the predicate *linguist* can be interpreted optimally as “syntactician” or “linguist in this department”, but not as “scholar” or, let’s say, “crocodile”. Optimisation then takes place in two steps. First, we select from $\mathcal{P}(F(P)(w))$ the sets that are maximal with respect to the relevance ordering $<_P$ (640), cf. $\max_{<_P}(\mathcal{P}(F(P)(w)))$ in (653), i.e. constraint $\neg \exists Y \subseteq F(P)(w)[Y >_P X]$ in (652). The idea behind this constraint is that the optimal interpretation is the *most relevant* one. In the second step, the “smallest” sets are chosen among the remaining candidates, i.e. sets that are minimal wrt. set inclusion: $\min_C(\max_{<_P}(\mathcal{P}(F(P)(w))))$, cf. constraint $\neg \exists Z \subset X[Z =_P X]$ in (652).²⁹ Van Rooy (2003b) proposes to view these constraints as a possible formal interpretation of the Principle of Relevance in Relevance Theory (Sperber and Wilson, 1986, 1995). The first constraint corresponds to the relevance-theoretic “maximisation of the number of contextual implications”, whereas the second constraint is intended as an approximation of the relevance-theoretic “minimisation of processing effort”. In the current setting “effort” boils down to giving/receiving more information than is needed.

The last thing to be noted about the definition in (652)–(653) is that it allows, in principle, for multiple optimal interpretations of the same predicate in the same world. (If P is a one-place predicate, $O(P)(w)$ is a set of sets of individuals, whereas $F(P)(w)$ is simply a set of individuals, i.e. $O(P)(w)$ and $F(P)(w)$ are not *quite* the same object type.) However, $O(P)(w)$ contains more than one element only if the underlying relevant question is a mention-some question (i.e. has intersecting cells, see fn. 23 on p. 246). I will continue to disregard mention-some questions, and since in all other cases $O(P)(w)$ is a singleton set (see e.g. van Rooij and Schulz, 2004b, p. 24), $O(P)(w)$ will be

²⁸The simplified formulation presented in van Rooij and Schulz (2004b), if taken literally, does not make the same predictions for indefinite descriptions.

²⁹In the original definition, this constraint uses \approx_P , rather than $=_P$, $\neg \exists Z \subset X[Z \approx_P X]$, i.e. to be comparable in terms of size, set Z only needs to be *approximately* as relevant as set X with respect to predicate P . This might be useful if the relevance ordering $<_P$ is more directly related to the numerical notion of utility, as e.g. in van Rooy (2003a). With the categorical definition of $<_P$ used here, cf. (640) and (641), strict equality does just the same job and so will be used instead of \approx_P .

identified with its unique element, so for instance, I will write $O(P)(w) = \{j, m\}$ for $O(P)(w) = \{\{j, m\}\}$.

To illustrate how this definition works, let's consider once again Sue's decision problem and the corresponding relevant question shown in Table 6.10. What is the optimal interpretation of the predicate *smoke* in this context? Recall that we have already computed the \langle_{smoke} ordering on sets of individuals induced by the decision problem, see Figure 6.8. The optimal interpretation of *smoke* can now be obtained for each world w by (a) finding the power set of $F(smoke)(w)$ in that world; (b) maximising that set wrt. the \langle_{smoke} ordering; and then (c) finding the smallest set in the resulting set of sets.

For instance, what is the optimal interpretation of *smoke* in world w_{11} , $O(smoke)(w_{11})$? To start with, the conventional interpretation of *smoke* in that world is $\{j, m, b\}$, $F(smoke)(w_{11}) = \{j, m, b\}$, as shown in Table 6.10. The set of all interpretations that are at least that specific is the set of all subsets of $F(smoke)(w_{11})$, given in (654a). As Figure 6.8 makes clear, the most relevant interpretations are $\{j, m, b\}$ and $\{j, m\}$ (which are in turn equal in terms of relevance, $\{j, m, b\} =_{smoke} \{j, m\}$), cf. (654b). But $\{j, m\}$ is a proper subset of $\{j, m, b\}$, hence minimising $\{\{j, m, b\}, \{j, m\}\}$ with respect to \subset gives $\{\{j, m\}\}$, cf. (654c). Thus the optimal interpretation of *smoke* in world w_{11} is $\{j, m\}$, $O(smoke)(w_{11}) = \{j, m\}$. Notice that the optimal interpretation $O(smoke)(w_{11})$ deviates from the conventional interpretation $F(smoke)(w_{11})$ in that it excludes the irrelevant individual b (Bill).

$$(654) \text{ a. } \mathcal{P}(F(smoke)(w_{11})) = \{\{j, m, b\}, \{j, m\}, \{j, b\}, \{m, b\}, \{j\}, \{m\}, \{b\}, \emptyset\}$$

$$\text{ b. } \max_{\langle_{smoke}}(\mathcal{P}(F(smoke)(w_{11}))) = \{\{j, m, b\}, \{j, m\}\}$$

$$\text{ c. } \min_{\subset}(\max_{\langle_{smoke}}(\mathcal{P}(F(smoke)(w_{11})))) = \{\{j, m\}\}$$

The same computations for worlds w_{12} and w_{13} are shown in (655) and (656), respectively. In w_{12} , the optimal interpretation of *smoke* turns out to be the same as in world w_{11} , $O(smoke)(w_{12}) = \{j, m\}$. In world w_{13} on the other hand, the optimal extension of *smoke* only contains John, $O(smoke)(w_{13}) = \{j\}$. This is so because the power set of $F(smoke)(w_{13})$ does not include $\{j, m, b\}$ or $\{j, m\}$, cf. (656a), hence the maximal elements wrt. the \langle_{smoke} relevance ordering among those available in (656a), are $\{j, b\}$ and $\{j\}$ (656b), as is evident from Figure 6.8. Among these, $\{j\}$ is minimal in terms of set-theoretical inclusion.

$$(655) \text{ a. } \mathcal{P}(F(smoke)(w_{12})) = \{\{j, m\}, \{j\}, \{m\}, \emptyset\}$$

$$\text{ b. } \max_{\langle_{smoke}}(\mathcal{P}(F(smoke)(w_{12}))) = \{\{j, m\}\}$$

$$\text{ c. } \min_{\subset}(\max_{\langle_{smoke}}(\mathcal{P}(F(smoke)(w_{12})))) = \{\{j, m\}\}$$

$$(656) \text{ a. } \mathcal{P}(F(smoke)(w_{13})) = \{\{j, b\}, \{j\}, \{b\}, \emptyset\}$$

$$\text{ b. } \max_{\langle_{smoke}}(\mathcal{P}(F(smoke)(w_{13}))) = \{\{j, b\}, \{j\}\}$$

$$\text{ c. } \min_{\subset}(\max_{\langle_{smoke}}(\mathcal{P}(F(smoke)(w_{13})))) = \{\{j\}\}$$

If we continue the same computations for other worlds in W , what we find is that in all worlds where the conventional interpretation of *smoke* is $\{j, m, b\}$ or $\{j, m\}$, the optimal interpretation is $\{j, m\}$; in worlds where $F(smoke)$ returns $\{j, b\}$ or $\{j\}$, $O(smoke)$ will return $\{j\}$, and so on. Thus $O(smoke)$ looks like $F(smoke)$ with the difference that the irrelevant individual b has been subtracted from all extensions. In other words, on its optimal interpretation, *smoke* is roughly synonymous with *smoke except Bill* ($\lambda x[smoke(x) \wedge x \neq b]$). This is quite a satisfactory result, since it corresponds to our intuitions about the *real*

sense of the expression *smoke in the hallway* in the dialogue (657)–(658) occurring in a situation where Bill is irrelevant, as is the case given Sue’s decision problem (cf. pp. 247–248).

(657) Who smokes in the hallway?

(658) A linguist.

The next question is how the optimal interpretation of the question predicate enters the exhaustive interpretation of the answer. Van Rooij and Schulz (2004b) propose that the relevance ordering $<_P$ (on worlds) that is used in the definition of exhaustive interpretation, repeated in (659), can be redefined in terms of optimal interpretation of the question predicate, cf. (660). Thus, instead of relating the conventional interpretations of P directly by the relevance ordering $<_P$ (on sets), cf. $F(P)(w_1) <_P F(P)(w_2)$ in (639), we again use classical set inclusion \subset , as in the original definition (638), but apply it to optimal rather than conventional interpretations of P . The resulting $<_P$ -order is equivalent to the one produced by the definition in (639).

(659) $s[[A]]_{exh}^P = s[[A]] \cap \min_{<_P}(s_0[[A]])$

(660) $w_1 <_P w_2$ iff
 a. $O(P)(w_1) \subset O(P)(w_2)$, and
 b. for all $R \in \mathcal{X}$, $F(R)(w_1) = F(R)(w_2)$.

But obviously this is not enough to solve the problem with the exhaustive interpretation of indefinite descriptions like (658), discussed on p. 254 and illustrated in Figure 6.10. If the definitions (639) and (660) are equivalent, then other things being equal, we get the same exhaustive interpretation for *A linguist smokes* (658), that is, in worlds where Bill (the irrelevant) is a linguist, the extension of *smoke* is minimised to the singleton $\{b\}$, as shown in Figure 6.10, so the exhaustive interpretation of *a linguist* refers to Bill. In other words, the problem remains.³⁰ It seems however, that the problem can be solved straightforwardly if (and this is what I propose) the question predicate is also interpreted optimally in the answer. This means that the normal, non-exhaustive interpretation of the answer $s_0[[A]]$ that constrains the exhaustive interpretation in (659) should be based on O rather than F .

Assume for the moment that only the question predicate (in this case *smoke*) is interpreted optimally in the answer, whereas all other predicates are interpreted in the conventional way. In this case the non-exhaustive interpretation of *A linguist smokes* would contain the worlds where there is at least one individual that is both in the conventional interpretation of *linguist* and the optimal interpretation of *smoke*, i.e. $F(linguist)(w) \cap O(smoke)(w) \neq \emptyset$. All such worlds are highlighted in green (dashed or solid line) in Table 6.12. Notice that now the worlds where Bill is the only linguist that smokes (on the conventional interpretation) do not belong to $s_0[[A \text{ linguist smokes}]]$, since Bill, being irrelevant, *does not smoke* on the optimal interpretation. This is the most crucial difference from the previous analysis, cf. Table 6.11. Since the worlds where Bill is the only linguist who smokes are not in $s_0[[A \text{ linguist smokes}]]$ anymore, they

³⁰It should be noted that van Rooij’s motivation for introducing relevance-based optimal interpretation was different from ours. His primary purpose was to get context dependent interpretations of interrogatives, including embedded interrogatives (see van Rooij, 2003a). Optimal interpretation did not play any special role in the exhaustification of answers.

are not considered when the question predicate is minimised with respect to $<_{smoke}$, as shown in Figure 6.11 (see Figure 6.10 for comparison). Therefore the exhaustive interpretation of *A linguist smokes* (worlds marked with green solid line ovals in Table 6.12) entails that *apart from Bill* exactly one linguist smokes, regardless of whether Bill himself is a linguist or not. In other words, *a linguist* in (658) cannot refer to Bill.

This analysis thus provides an intuitively correct exhaustive interpretation for indefinite descriptions like (658), and moreover, it recovers the coreference effect in restatements that involve indefinite descriptions. For instance in (662), clearly, if some linguist is the only person who smokes except Bill, and Mary is the only person who smokes except Bill, then Mary must be that linguist. This is shown once again in Table 6.12. The intersection of the exhaustive interpretation of *Mary* (red solid line ovals) with the exhaustive interpretation of *a linguist* (green solid line) is listed in (663). In all these worlds Mary is a linguist; whereas Bill might be a linguist or not, and might smoke or not.

(661) Who smokes in the hallway?

- (662) a. A linguist. Mary.
b. Mary. A linguist.

$$(663) s_0[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]_{exh}^{smoke}[\textit{smoke}(m)]_{exh}^{smoke} = \{w_{15}, w_{16}, w_{25}, w_{26}, w_{55}, w_{56}, w_{65}, w_{66}\}$$

Thus this result was reached by assuming that only the question predicate is interpreted optimally in the answer. This was sufficient for the current example, but it is easy to see that other cases require all predicates in the answer to be interpreted optimally. The simplest case would be a universal quantifier like *every linguist* (665).

(664) Who smokes in the hall way?

- (665) Every linguist.

The intuition is that in a situation where Bill is irrelevant, (665) means “every linguist apart from Bill,” that is, if Bill is not a linguist then *every linguist* can be interpreted literally, and if Bill is a linguist, *every linguist* means “every linguist other than Bill.” However, if we combine the conventional interpretation of *linguist* with the optimal interpretation of *smoke*, the proposition that every linguist smokes turns out to be false in worlds where Bill is a linguist, obviously, since Bill *does not smoke* on the optimal interpretation. This could be repaired if the predicate *linguist* is interpreted optimally, too, and if the irrelevant individuals are excluded from its optimal interpretation, just as they are from the optimal interpretation of the question predicate.

Fortunately, the definition of optimal interpretation (653) that has only been used for question predicates so far, appears suitable for other predicates as well. For the given decision problem, where it does not only matter for Sue who smokes (except Bill) but also who (except Bill) is in which department (see pp. 247–248), the relevance ordering $<_{linguist}$ on sets of individuals turns out to be equivalent to $<_{smoke}$, cf. Figure 6.8. Therefore just like in the case of *smoke*, in worlds where $F(\textit{linguist})$ is $\{j, m, b\}$ or $\{j, m\}$, the optimal interpretation of *linguist* is $\{j, m\}$; in worlds where $F(\textit{linguist})$ is $\{j, b\}$ or $\{j\}$, $O(\textit{linguist})$ is $\{j\}$, and so on, i.e. the irrelevant individual b is excluded from all extensions

$smoke \xrightarrow{O}$	$\{j, m\}$		$\{j\}$		$\{m\}$		\emptyset	
$smoke \xrightarrow{F}$	$\{j, m, b\}$	$\{j, m\}$	$\{j, b\}$	$\{j\}$	$\{m, b\}$	$\{m\}$	$\{b\}$	\emptyset
$linguist \xrightarrow{F} \{j, m, b\}$ $linguist \xrightarrow{O} \{j, m\}$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	w_{16}	w_{17}	w_{18}
$linguist \xrightarrow{F} \{j, m\}$ $linguist \xrightarrow{O} \{j, m\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	w_{26}	w_{27}	w_{28}
$linguist \xrightarrow{F} \{j, b\}$ $linguist \xrightarrow{O} \{j\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	w_{36}	w_{37}	w_{38}
$linguist \xrightarrow{F} \{j\}$ $linguist \xrightarrow{O} \{j\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	w_{46}	w_{47}	w_{48}
$linguist \xrightarrow{F} \{m, b\}$ $linguist \xrightarrow{O} \{m\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	w_{56}	w_{57}	w_{58}
$linguist \xrightarrow{F} \{m\}$ $linguist \xrightarrow{O} \{m\}$	w_{61}	w_{62}	w_{63}	w_{64}	w_{65}	w_{66}	w_{67}	w_{68}
$linguist \xrightarrow{F} \{b\}$ $linguist \xrightarrow{O} \emptyset$	w_{71}	w_{72}	w_{73}	w_{74}	w_{75}	w_{76}	w_{77}	w_{78}
$linguist \xrightarrow{F} \emptyset$ $linguist \xrightarrow{O} \emptyset$	w_{81}	w_{82}	w_{83}	w_{84}	w_{85}	w_{86}	w_{87}	w_{88}

Table 6.12: For each world in the initial information state s_0 , the conventional interpretation $F(smoke)$ in that world is given in the lower heading of the corresponding column following $smoke \xrightarrow{F}$; the optimal interpretation $O(smoke)$ is in the upper column heading following $smoke \xrightarrow{O}$. The value of $F(linguist)$ and $O(linguist)$ for each world is given in the corresponding row. On the assumption that the question predicate $smoke$ is interpreted optimally in $s_0[\cdot]^O$, marked worlds constitute the following propositions: green ovals (dashed or solid line): $s_0[\exists x[linguist(x) \wedge smoke(x)]]^O$; green solid line ovals: $s_0[\exists x[linguist(x) \wedge smoke(x)]]_{exh}^{smoke}$; red ovals (dashed or solid line): $s_0[smoke(m)]^O$; red solid line ovals: $s_0[smoke(m)]_{exh}^{smoke}$.

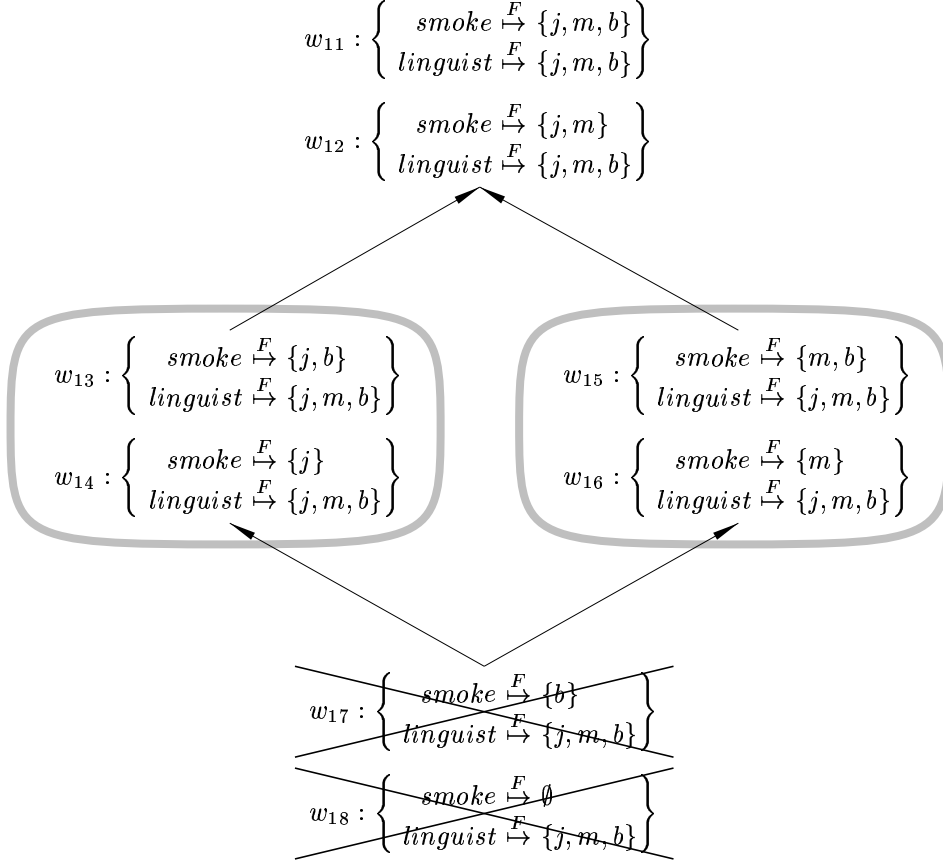


Figure 6.11: The relevance ordering $<_{smoke}$ of the worlds $\{w_{11}, w_{12}, w_{13}, w_{14}, w_{15}, w_{16}, w_{17}, w_{18}\}$ where $F(\text{linguist}) = \{j, m, b\}$, i.e. Bill is one of the linguists. The crossed out worlds w_{17} and w_{18} are excluded from the non-exhaustive interpretation of *A linguist smokes*, $s_0[\exists x[\text{linguist}(x) \wedge \text{smoke}(x)]]$, on the assumption that the question predicate *smoke* is interpreted optimally in $s[\cdot]$. Although the intersection of $F(\text{smoke})(w_{17})$ and $F(\text{linguist})(w_{17})$ is non-empty, the intersection of $O(\text{smoke})(w_{17})$ and $F(\text{linguist})(w_{17})$ is empty (cf. Table 6.12), hence the world w_{17} is not in $s_0[\exists x[\text{linguist}(x) \wedge \text{smoke}(x)]]$ and is not taken into account by the minimisation. Therefore the worlds w_{13}, w_{14}, w_{15} , and w_{16} are the ones that are minimal wrt. $<_{smoke}$ and enter the exhaustive interpretation of *A linguist smokes*, rather than w_{17} (cf. Figure 6.10).

(cf. Table 6.12).³¹

In order to integrate this idea into the current analysis, the only thing that is needed is a notion of *optimal update* that is based on the optimal interpretation function instead of the conventional one. This update function $s[\cdot]^O$ should be like the conventional update function $s[\cdot]$ with the exception of the rule for atomic formulas. Although the precise definition of $s[\cdot]$ has not been spelled out yet,³² the assumption has been all along that its definition contains a clause for the interpretation of atomic formulas that looks something like (666), where R is a one-place predicate symbol, x is an individual variable, and g is an assignment function that maps x to an individual in the domain D . In the optimal update $s[\cdot]^O$, (666) is replaced by (667), i.e. F is replaced by O .

$$(666) s[R(x)] = \{w \in s \mid g(x) \in F(R)(w)\}$$

$$(667) s[R(x)]^O = \{w \in s \mid g(x) \in O(R)(w)\}$$

Optimal update should then be used in the definition of exhaustive interpretation. On the most conservative approach, $s[\cdot]^O$ is only used to define the set of worlds to be minimised with respect to $<_P$, as in (668) and (669) (the same definition in two alternative notations).

$$(668) s[A]_{exh}^P = \{w \in s[A] \mid \neg \exists v \in s_0[A]^O [v <_P w]\}$$

$$(669) s[A]_{exh}^P = s[A] \cap \min_{<_P}(s_0[A]^O)$$

However, it seems at least harmless to replace the conventional update completely by the optimal one, cf. (670).³³

$$(670) s[A]_{exh}^P = s[A]^O \cap \min_{<_P}(s_0[A]^O)$$

These adjustments are needed to formalise the current proposal, although a more systematic formalisation is carried out in Appendix B. To summarise the discussion so far, the notion of optimal interpretation proposed by van Rooij (2004) is a necessary component of the exhaustive interpretation of answers. In order to give a plausible exhaustive interpretation to indefinite descriptions as well as universal quantifiers in contexts that give rise to a domain restriction, optimal interpretation should not only be used to define the relevance ordering

³¹In general, the relevance orderings of the subsets of D induced by two different predicates need not be identical even in the same decision problem. The $<_P$ ordering for predicates other than the question predicate depends on whether or not these predicates make any distinctions between the cells of the relevant question partition, and what kind of distinctions they make. For instance, if the relevant question is such that the agent is only interested in the names of individuals that smoke, and not in their departments, then the predicate *linguist* does not make any useful distinctions. In this case the $<_{linguist}$ ordering would collapse completely and the optimal interpretation of *linguist* would collapse to \emptyset in all worlds.

This is an interesting fact that could be used as a natural constraint on the *ceteris paribus* condition in the definition of $<_P$ on worlds, cf. (660). Using O instead of F also in the *ceteris paribus* condition, as shown in (i), would be equivalent to restricting \mathcal{X} to the subset of language that is useful for dealing with the current relevant question, since irrelevant predicates would turn out to have the same extension in all worlds.

(i) $w_1 <_P w_2$ iff
a. $O(P)(w_1) \subset O(P)(w_2)$, and
b. for all $R \in \mathcal{X}$, $O(R)(w_1) = O(R)(w_2)$.

³²See Appendix B for the final formal definition.

³³In fact, this move is necessary for the correct account of universal quantifiers.

$<_P$, but the notion of non-exhaustive update should also be based on the optimal interpretation function. Thus optimal interpretation should be granted an even more prominent place in the overall theory of exhaustification than originally envisaged by van Rooij and Schulz.

6.4.4 Relevance in restatements

Now that we have a relevance-sensitive notion of exhaustification that works for all types of expressions we are interested in, the next question to address is what consequences the relevance parameter has for an exhaustivity-based theory of restatement.

Already in Chapter 4 (Section 4.3.3) it was pointed out that an essential prerequisite for inferring coreference in restatements with the help of exhaustification is the assumption that both parts of a restatement answer *the same* question, i.e. are exhaustivized with respect to the same question predicate, such as P in (671).

$$(671) \text{ exh}(A_1, P) \wedge \text{ exh}(A_2, P)$$

This assumption was enough as long as we were using a theory of exhaustification that took no account of relevance. However, with the approach introduced in the previous sections, where one and the same predicate can have multiple optimal interpretations, identity of the question predicate symbols does not grant yet that A_1 and A_2 answer the same question. So it seems that the *relevant question* Q must be kept constant across utterances in a restatement, too, as shown in (672). Since the relevant question determines the optimal interpretation of P ,³⁴ (672) guarantees that P receives the same interpretation while processing A_1 and A_2 , and the appropriate coreference relations can be inferred between A_1 and A_2 . The constancy of the relevant question was implicitly assumed in the analysis of the examples discussed in the previous sections, and coreference was successfully inferred.

$$(672) s[[A_1]_{\text{exh}}^{Q,P}][A_2]_{\text{exh}}^{Q,P}$$

However, a closer consideration shows that a weaker assumption might be sufficient, and in fact, more adequate. If we directly require that A_1 and A_2 be interpreted with respect to the same optimal interpretation of the question predicate, as shown in (673), the coreference effect can still be inferred, while the relevant questions Q_1 and Q_2 that A_1 and A_2 address may be distinct.

$$(673) s[[A_1]_{\text{exh}}^{O_1(P)}][A_2]_{\text{exh}}^{O_2(P)}, \text{ where } O_1(P) = O_2(P)$$

An example of two distinct relevant question partitions that give rise to the same optimal interpretation of the question predicate is as follows. Let's consider a somewhat simplified version of the "smoking in the hallway" situation, summarised in (674), where Sue wants to know the list of persons that smoke in the hallway both by name and by department (for simplicity it will be assumed this time that Sue makes no exception to Bill or any other person).

³⁴Unless it is a mention-some question. See Section 6.7.1 for some related discussion.

$smoke \mapsto$	$\{j, m\}$	$\{j\}$	$\{m\}$	\emptyset
$ling \mapsto \{j, m\}$ $math \mapsto \emptyset$	w_{11}	w_{12}	w_{13}	w_{14}
$ling \mapsto \{j\}$ $math \mapsto \{m\}$	w_{21}	w_{22}	w_{23}	w_{24}
$ling \mapsto \{m\}$ $math \mapsto \{j\}$	w_{31}	w_{32}	w_{33}	w_{34}
$ling \mapsto \emptyset$ $math \mapsto \{j, m\}$	w_{41}	w_{42}	w_{43}	w_{44}

Table 6.13: The relevant question partition Q induced by the agent’s desire to know for each individual in the domain whether (s)he smokes or not, and if so, from which department (s)he is.

(674) Suppose Sue has a suspicion that someone smokes regularly in the hallway of the department building, which is a non-smoking area. And suppose, Sue would immediately complain to your boss once she finds out that you are doing some mischief. However, before Sue can complain, she needs to find out (a) the identity of the person, or persons, that smoke in the hallway; and (b) to which departments those persons belong (i.e. who are their bosses).

In a model that only contains two individuals John and Mary, the partition Q of the logical space representing Sue’s decision problem is as shown in Table 6.13. There are nine cells (highlighted by different colours) corresponding to the nine alternative actions that Sue is considering to take, which are the same as in the example discussed in Section 6.4.1, cf. (632). If Sue finds out in which cell of the partition the actual world is, she will know what to do.

As was already pointed out in Section 6.4.1, a relevant question of this sort cannot be fully resolved by an answer like *Mary* or *a linguist* alone. Only combining both answers in a restatement such as (676) communicates the necessary information for selecting exactly one cell of the given partition. So far it has been assumed that both answers that form (676) are interpreted exhaustively with respect to this kind of question (Q), as shown in (677).

(675) Who smokes in the hallway?

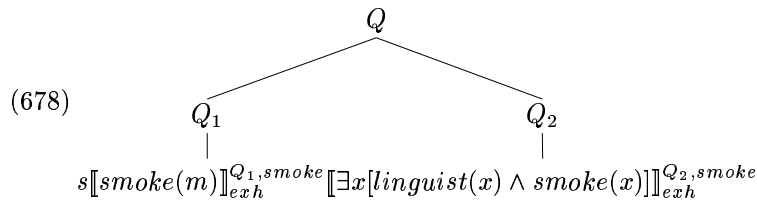
(676) Mary. A linguist.

(677) $s \llbracket smoke(m) \rrbracket_{exh}^{Q, smoke} \llbracket \exists x [linguist(x) \wedge smoke(x)] \rrbracket_{exh}^{Q, smoke}$

$smoke \mapsto$	$\{j, m\}$	$\{j\}$	$\{m\}$	\emptyset
$ling \mapsto \{j, m\}$ $math \mapsto \emptyset$	w_{11}	w_{12}	w_{13}	w_{14}
$ling \mapsto \{j\}$ $math \mapsto \{m\}$	w_{21}	w_{22}	w_{23}	w_{24}
$ling \mapsto \{m\}$ $math \mapsto \{j\}$	w_{31}	w_{32}	w_{33}	w_{34}
$ling \mapsto \emptyset$ $math \mapsto \{j, m\}$	w_{41}	w_{42}	w_{43}	w_{44}

Table 6.14: The relevant question partition Q_1 induced by the agent’s desire to know for each person (by name) whether (s)he smokes or not. Green: John and Mary smoke; red: only John smokes; blue: only Mary smokes; yellow: no one smokes.

However, one might want to argue that the utterances *Mary* and *a linguist* in (676) do not in fact address the same question. Instead, the main question Q is split up into two subquestions Q_1 and Q_2 , where Q_1 asks for a list of smokers by name, and Q_2 by department. Then *Mary* is an answer to the first question, and *a linguist* to the second.



The partitions corresponding to Q_1 and Q_2 are shown in Tables 6.14 and 6.15, respectively. It is easy to see that if we pick a single cell in both Q_1 and Q_2 , their intersection (if non-empty) will correspond to exactly one cell in Q . In other words, knowing a complete answer to both Q_1 and Q_2 means knowing a complete answer to Q , or in Groenendijk and Stokhof’s terms, Q_1 and Q_2 jointly entail Q :

(679) $Q_1, Q_2 \models Q$

However, although Q_1 and Q_2 are not identical, they both give rise to the same optimal interpretation of the question predicate $smoke$,³⁵ and this

³⁵The optimal interpretation functions induced by Q_1 and Q_2 differ in the values they

$smoke \mapsto$	$\{j, m\}$	$\{j\}$	$\{m\}$	\emptyset
$ling \mapsto \{j, m\}$ $math \mapsto \emptyset$	w_{11}	w_{12}	w_{13}	w_{14}
$ling \mapsto \{j\}$ $math \mapsto \{m\}$	w_{21}	w_{22}	w_{23}	w_{24}
$ling \mapsto \{m\}$ $math \mapsto \{j\}$	w_{31}	w_{32}	w_{33}	w_{34}
$ling \mapsto \emptyset$ $math \mapsto \{j, m\}$	w_{41}	w_{42}	w_{43}	w_{44}

Table 6.15: The relevant question partition Q_2 induced by the agent’s desire to know how many employees of which *departments* smoke. Pink: two linguists smoke; green: one linguist (John) and one mathematician smoke (Mary); brown: one linguist (Mary) and one mathematician (John) smoke; magenta: two mathematicians smoke; blue: one linguist smokes; red: one mathematician smokes; yellow: no one smokes.

is enough for inferring a coreference relation between *Mary* and *a linguist* in (676). If Mary is the only person who smokes, and some linguist is the only person who smokes *in the same sense*, then Mary must be that linguist.

Of course, Q could also be split up differently, so the resulting subquestions impose different optimal interpretations on the question predicate. A possible example would be Q'_1 and Q'_2 where Q'_1 asks which men smoke in the hallway and if so in which departments they are; and Q'_2 asks the same thing about the women. In this case, Mary would be irrelevant to Q'_1 , and hence subtracted from all optimal extensions of *smoke*, whereas for Q'_2 , John would be irrelevant. Whatever is then given as answer to Q'_1 and Q'_2 , a coreference relation between these answers is not granted: if x is the only person who smokes *in one sense*, and y is the only person who smokes *in a different sense*, then x and y are not necessarily the same person.

This could be seen as a problem, a trivialisation of the whole approach. If there are no constraints on the possible implicit subquestions a relevant question can be split up into, then any pair of utterances (even with falling intonation on both) could have both a coreference and a non-coreference reading. I.e. even such a discourse as (680) would be predicted to be felicitous if Q_1 and Q_2 are chosen appropriately.

assign to the predicates *linguist* and *mathematician*. Whereas for Q_2 the predicates are differentiated, for Q_1 their extensions are collapsed to an empty set in all worlds.

(680) # A child \searrow . An adult \searrow .

Of course, this is not the intended result, and some constraints on the choice of the implicit questions will be proposed in Chapter 7. For the time being, however, it is safest to assume that utterances that form an answer to an explicit query are also interpreted with respect to the same relevant question partition (and the same question predicate symbol, as always), although in general, a requirement of identical optimal interpretations of the question predicate would be enough to infer coreference.

6.4.5 Old information is irrelevant

After this lengthy excursus into the theory of relevance, we should finally reconsider the original question that this section started out to address, namely, how information is accumulated in the course of exhaustive update. Thus we should consider discourses like (681)–(682) in a situation where it is *known* that Bill smokes in the hallway, so the information state and the relevant question could look, for instance, as shown in Table 6.16. The situation behind the partition in Table 6.16 is like in the previous example, i.e. the agent wants to know who smokes—by name and by department—and for whatever reason, does not care about Bill’s department, but, unlike the previous example, the agent already knows that Bill smokes.

(681) Who smokes in the hallway?

- (682) a. A linguist. Mary.
b. Mary. A linguist.

The theory of relevance sketched out above predicts that if it is known that Bill smokes then it is irrelevant whether he does. Applying the definition of the relevance order (640) to the relevant question represented in Table 6.16 gives rise to a $<_{smoke}$ relation on $\mathcal{P}(D)$ that is equivalent to $<_{smoke}$ computed for the previous case, cf. Figure 6.8. That is, sets that differ only in whether they include or exclude Bill are equally relevant wrt. *smoke*.³⁶ But since the $<_{smoke}$ relevance orderings are equivalent, the optimal interpretations of the predicate *smoke* are equivalent, too. (Optimal interpretations of other predicates are equivalent as well, since we assumed that apart from the status of Bill’s smoking the current relevant question is like the previous one, cf. Table 6.10.) This in turn implies that the exhaustive update of the minimal information state s_0 leads to the same result as in the previous example, cf. (663), repeated below.

(683) $s_0[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]_{exh}^{smoke}[\textit{smoke}(m)]_{exh}^{smoke} =$
 $\{w_{15}, w_{16}, w_{25}, w_{26}, w_{55}, w_{56}, w_{65}, w_{66}\}$

The only difference now is that information state s we are updating is not minimal (s_0), but already contains the information that Bill smokes ($s =$ worlds that are not crossed out in Table 6.16). That is, we need to find (684).

(684) $s[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]_{exh}^{smoke}[\textit{smoke}(m)]_{exh}^{smoke}$

³⁶For example, $\{j, m, b\} =_{smoke} \{j, m\}$ since the proposition $\{w | \{j, m, b\} \subseteq F(\textit{smoke})(w)\}$ excludes all the same cells of the relevant question partition in Table 6.16 as the proposition $\{w | \{j, m, b\} \subseteq F(\textit{smoke})(w)\}$ does, see definitions (640) and (641) and the subsequent example on p. 252.

$smoke \mapsto$	$\{j, m, b\}$	$\{j, m\}$	$\{j, b\}$	$\{j\}$	$\{m, b\}$	$\{m\}$	$\{b\}$	\emptyset
$ling \mapsto \{j, m, b\}$ $math \mapsto \emptyset$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	w_{16}	w_{17}	w_{18}
$ling \mapsto \{j, m\}$ $math \mapsto \{b\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	w_{26}	w_{27}	w_{28}
$ling \mapsto \{j, b\}$ $math \mapsto \{m\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	w_{36}	w_{37}	w_{38}
$ling \mapsto \{j\}$ $math \mapsto \{m, b\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	w_{46}	w_{47}	w_{48}
$ling \mapsto \{m, b\}$ $math \mapsto \{j\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	w_{56}	w_{57}	w_{58}
$ling \mapsto \{m\}$ $math \mapsto \{j, b\}$	w_{61}	w_{62}	w_{63}	w_{64}	w_{65}	w_{66}	w_{67}	w_{68}
$ling \mapsto \{b\}$ $math \mapsto \{j, m\}$	w_{71}	w_{72}	w_{73}	w_{74}	w_{75}	w_{76}	w_{77}	w_{78}
$ling \mapsto \emptyset$ $math \mapsto \{j, m, b\}$	w_{81}	w_{82}	w_{83}	w_{84}	w_{85}	w_{86}	w_{87}	w_{88}

Table 6.16: The relevant question: Partition of W induced by the agent’s desire to know for all individuals except Bill whether they smoke or not, and if they do, to which department they belong. Worlds belonging to different cells of the partition are highlighted with different colours. For instance, the worlds $\{w_{11}, w_{12}, w_{21}, w_{22}\}$ (pink) constitute the partition cell in which Sue’s most useful action is to tell the head of the linguistics department that John and Mary smoke (632a. Legend: **Pink:** apart from Bill, John and Mary smoke and are both linguists; **Brown:** apart from Bill, John (a linguist) and Mary (a mathematician) smoke; **Light blue:** apart from Bill, John (a mathematician) and Mary (a linguist) smoke; **Magenta:** apart from Bill, John and Mary smoke and are both mathematicians; **Dark blue:** apart from Bill, only John smokes and he is a linguist; **Yellow:** apart from Bill, only John smokes and he is a mathematician; **Green:** apart from Bill, only Mary smokes and she is a linguist; **Red:** apart from Bill, only Mary smokes and she is a mathematician; **Grey:** no one smokes apart from Bill.

However, the contribution of s is simply additive in the current case. Recall the observation made in Section 6.3.3 that if the answers A and A' do not have classical dynamic effects in the non-exhaustive update then the statements (685) and (686) hold, i.e. the successive exhaustive update of state s with A and A' is equivalent to updating s separately with A and with A' and then intersecting (conjoining) the results. Obviously, (687) follows from (685) and (686).

$$(685) s[[A]_{exh}^P] = s \cap s_0[[A]_{exh}^P]$$

$$(686) s[[A]_{exh}^P][[A']_{exh}^P] = s[[A]_{exh}^P] \cap s[[A']_{exh}^P]$$

$$(687) s[[A]_{exh}^P][[A']_{exh}^P] = s \cap s_0[[A]_{exh}^P][[A']_{exh}^P]$$

The propositions *A linguist smokes* and *Mary smokes* do not give rise to dynamic effects in the current setting, hence the set of worlds $s_0[[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]_{exh}^{smoke}][[\textit{smoke}(m)]_{exh}^{smoke}]$, previously computed, can simply be intersected with s . This yields (688) as the meaning of the restatements in (682) in the given context, which entails (a) that Bill smokes; (b) that except Bill, only Mary smokes (i.e. John does not); and (c) that Mary is a linguist, whereas it remains open whether Bill or John are linguists as well. This is the intuitively plausible interpretation of (682). Thus with the help of relevance, the problems with the exhaustive interpretation of indefinite descriptions discussed in Section 6.3.2 can be solved.

$$(688) s[[\exists x[\textit{linguist}(x) \wedge \textit{smoke}(x)]]_{exh}^{smoke}][[\textit{smoke}(m)]_{exh}^{smoke}] = \{w_{15}, w_{25}, w_{55}, w_{65}\}$$

This suggests that the influence of old information on exhaustive interpretation is not direct, but is mediated by relevance. A theory that implements such an indirect connection, such as the one developed in this section, performs better than a theory that makes exhaustification directly sensitive to all information available in the context.

As a final remark, obviously, van Rooij and Schulz' theory, as well as its modified version presented in this section, makes relevance a very powerful mechanism. Using it, one is easily in danger of trivialising all the predictions related to the concept of exhaustivity. In particular in connection with the example discussed above, one could wonder whether restatement, i.e. answering the same question twice, is possible at all. If old information is able to change the relevance relations in the way suggested above then the information conveyed by the first element of a restatement, e.g. *Mary* in (682b), should affect the relevant question, the related relevance orderings and the optimal interpretation function in a similar way as any background information does. In that case, the relevant question addressed by the second element of a restatement would necessarily be different from that addressed by the first element, and generally, no coreference effect could be derived. This problem will be dealt with in Chapter 7, where I will argue that the relation between old information and relevance is not as direct as the above discussion might suggest. In particular, the accumulated information does not automatically update the optimal interpretation function, and any change of optimal interpretation should be explicitly signalled.

6.5 Interim summary

To complete the part of this chapter which was devoted to the presentation of van Rooij and Schulz original version of the theory of exhaustification and the proposed adjustments in connection with its application to restatements, let's briefly summarise the results so far.

In the last two sections I investigated the question how exhaustive update interacts with the information accumulated in the common ground of the discourse participants. As a starting point I took van Rooij and Schulz' (2004b) proposal 'as is', which makes exhaustification unselectively sensitive to all information contained in the current information state. It was shown that this approach gives rise to two problems: one concerning restatements that involve unequal groups; the other having to do with the exhaustive interpretation of indefinite descriptions in non-minimal information states, and consequently, with restatements that involve indefinite descriptions. These problems were solved by *reducing the role of information* and *increasing the role of relevance* in the theory of exhaustive interpretation. First, I argued that exhaustification should make a distinction between lexical knowledge and other kinds of information. Sensitivity to lexical information should be preserved, so exhaustive interpretation can never produce a proposition that contradicts the basic meaning postulates (cf. Section 6.1). By contrast, all other information should be disregarded in the course of exhaustive update. This move already solved the first of the two problems and was additionally motivated by the consideration (cf. Asher and Lascarides, 2003) that during discourse processing the lexicon is much more readily accessible than general world knowledge. As for cases that have traditionally been attributed to the effect of accumulated information, I showed that they can alternatively be handled using the mechanism of relevance (van Rooij, 2003a,b; van Rooij, 2004; van Rooij and Schulz, 2004b). However, in order to cope with the exhaustive interpretation of indefinite descriptions in non-minimal information states (the second problem), van Rooij's proposal had to be modified. The proposed solution required a more extensive use of relevance-driven optimal interpretations than in van Rooij's original proposal.

6.6 Sentential restatement and elaboration

In the previous sections I introduced (and modified where necessary) the most essential elements of van Rooij and Schulz' theory of exhaustification that are needed for a proper analysis of restatement. The proposals were tested on NPs leading to the inference of coreference and part-whole relations between individuals and groups. In this section, I will briefly consider an application of the resulting theory to coreference and part-whole relations between events, i.e. sentential restatement and elaboration.

The same analogy between the domain of individuals and the domain of events is used here as in connection with Groenendijk and Stokhof's (1984) theory in Chapter 5, so the predictions are also largely the same. For illustration, let's consider the discourse in (689)–(690) once again.³⁷ This is an instance of restatement that involves elaboration. The events described in the second

³⁷The same example was discussed in connection with Groenendijk and Stokhof's approach on p. 196, cf. (486).

sentence (690b) are both *part of* the complex opening event in the first sentence (690a). How is this part-whole relationship derived in the current setting?

(689) What happened?

- (690) a. John opened the door.
 b. He unlocked it and pushed it.

Let's assume that the domain of events consists of three atomic events e_1 , e_2 and e_3 , and their sums $e_1 \oplus e_2 \oplus e_3$, $e_1 \oplus e_2$, and so on. As I argued earlier, verbs like *happen* have the property to distribute over subevents, so if a complex event happened, all the simpler events that it consisted of happened, too, and *vice versa*. This is captured by the meaning postulate (691).

(691) $\forall e_1 \forall e_2 [happen(e_1) \wedge happen(e_2) \leftrightarrow happen(e_1 \oplus e_2)]$

Since meaning postulates are constraints on the model and the initial information state s_0 , s_0 will only contain worlds that conform to (691), hence a world where the extension of *happen* is e.g. $\{e_1, e_2\}$ will simply not be available. As for the other predicates, first note some abbreviations: I will use the one-place predicate symbols *open*, *unlock*, and *push* (on events) meaning in fact the open logical forms of the whole clauses, i.e. the lambda terms listed in (692).

- (692) a. $\lambda e[open(e, j, the\ door)]$
 b. $\lambda e[unlock(e, j, the\ door)]$
 c. $\lambda e[push(e, j, the\ door)]$

For these predicates I will assume that they only refer to “singular” openings, unlockings or pushings (e.g. $\{e_1\}$, but not $\{e_1, e_2\}$), i.e. John opened the door means John opened the door *once*. However, we will allow these “singular” eventualities to be complex, that is, the extension of e.g. *open* in some worlds may be $\{e_1 \oplus e_2 \oplus e_3\}$ or $\{e_1 \oplus e_2\}$. In other words, \oplus is not interpreted here as an operation for forming pluralities, but rather as Link's (1983) material sum $+$, or as an operation for forming complex singularities like *a deck of cards* out of other singularities like single cards. Further, I will assume that *open*, *unlock* and *push* do not distribute over subevents, i.e. a proper part of a single opening is not an opening, a proper part of a single unlocking is not an unlocking, etc., which is consistent with the achievement/accomplishment readings of the VPs, cf. e.g. the meaning postulate in (693).³⁸

(693) $\forall e \forall e' [[open(e) \wedge e' < e] \rightarrow \neg open(e')]$

Even with these constraints, the number of all possible combinations of extensions of the given predicates is too huge to consider a complete model that makes all necessary distinctions, therefore I will concentrate on a number of representative cases. Table 6.17 presents five “interesting” combinations of extensions of *open*, *unlock*, and *push*. The first row contains worlds w where $F(open)(w) = \{e_1 \oplus e_2 \oplus e_3\}$, $F(unlock)(w) = \{e_1\}$, and $F(push)(w) = \{e_2\}$. This means that there is a complex opening event $e_1 \oplus e_2 \oplus e_3$ that involves unlocking (e_1) and pushing (e_2) as a proper part, but it also involves some other

³⁸This is an important restriction, since the exhaustification of sentences describing homogeneous processes (that do distribute over subevents) is more tricky in the current approach. A proper treatment of processes requires a dynamic system that keeps track of discourse referents. The formalisation presented in Appendix B takes care of this option.

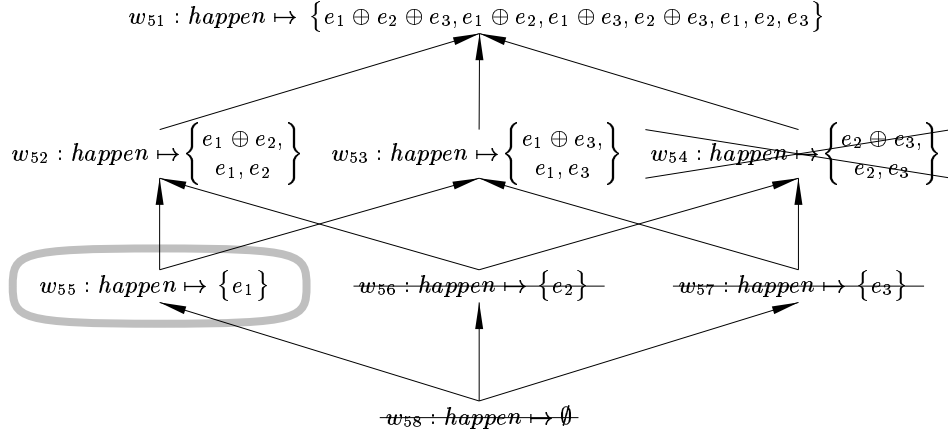


Figure 6.12:

action e_3 , which could be unbarring the door, or turning the door handle. The second row presents a case where unlocking and pushing is *all* the door opening is about. The complex opening event $e_1 \oplus e_2$ contains an unlocking e_1 and a pushing e_2 as a proper part, but the unlocking and the pushing taken together exhaust $e_1 \oplus e_2$. The third row corresponds to the possibility that the opening and the unlocking+pushing intersect but neither of them is part of the other. This could be the case, for instance, if John opened the door by unlocking and pulling it, and apart from that, pushed it (e.g. to close it again). In the fourth row, opening is a proper part of unlocking+pushing. John opens the door by just unlocking it, and pushes it independently. Finally, the last row represents the possibility that opening, unlocking and pushing are three distinct events that have nothing to do with each other. What is interesting about these cases is that in all of them the literal meaning of (690) is true (assuming that these events actually happened: the columns of Table 6.17 reflect the possibilities regarding which of these events happened). The simple conjunction of the clauses in (690) is satisfied since we indeed find an opening, an unlocking and a pushing event in all these worlds. The differences lie in the relations between these events, so next let's see how exhaustification constrains them.

As logical forms for (690a) and (690b), I will take (694a) and (694b), respectively.³⁹

- (694) a. $\exists e[\text{open}(e) \wedge \text{happen}(e)]$
 b. $\exists e \exists e'[\text{unlock}(e) \wedge \text{happen}(e) \wedge \text{push}(e') \wedge \text{happen}(e')]$

If the current relevant question behind (689) is such that everything is relevant, i.e. every world in Table 6.17 represents a separate cell of the partition, then the relevance ordering $<_{\text{happen}}$ on worlds reflects the set inclusion relations

³⁹Since van Rooij and Schulz' exhaustification takes sentential formulas, we can now work with closed propositions and no type-shifting of a sentence meaning to a quantifier type is needed. Cf. the discussion in Chapter 5, Section 5.3.2.

	<i>happen</i> \mapsto					
	$\{e_1, e_2, e_3, \dots\}$ $\{e_1 \oplus e_2 \oplus e_3\}$	$\{e_1, e_2\}$ $\{e_1 \oplus e_2\}$	$\{e_1, e_3\}$ $\{e_1 \oplus e_3\}$	$\{e_2, e_3\}$ $\{e_2 \oplus e_3\}$	$\{e_1\}$...
<i>open</i> $\mapsto \{e_1 \oplus e_2 \oplus e_3\}$ <i>unlock</i> $\mapsto \{e_1\}$ <i>push</i> $\mapsto \{e_2\}$	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	...
<i>open</i> $\mapsto \{e_1 \oplus e_2\}$ <i>unlock</i> $\mapsto \{e_1\}$ <i>push</i> $\mapsto \{e_2\}$	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	...
<i>open</i> $\mapsto \{e_1 \oplus e_2\}$ <i>unlock</i> $\mapsto \{e_1\}$ <i>push</i> $\mapsto \{e_3\}$	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	...
<i>open</i> $\mapsto \{e_1\}$ <i>unlock</i> $\mapsto \{e_1\}$ <i>push</i> $\mapsto \{e_2\}$	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	...
<i>open</i> $\mapsto \{e_1\}$ <i>unlock</i> $\mapsto \{e_2\}$ <i>push</i> $\mapsto \{e_3\}$	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	...
...

Table 6.17: The worlds in the body of the table represent a subset of the initial information state s_0 . For each world in the given subset, the conventional interpretation $F(\textit{happen})$ in that world is given in the heading of the corresponding column, the values of $F(\textit{open})$, $F(\textit{unlock})$, and $F(\textit{push})$ in the corresponding row. On the assumption that the optimal interpretation coincides with the conventional interpretation, the marked worlds represent the following propositions: green ovals (dashed or solid line): $s_0 \llbracket \exists x [\textit{open}(x) \wedge \textit{happen}(x)] \rrbracket^O$; green solid line ovals: $s_0 \llbracket \exists x [\textit{open}(x) \wedge \textit{happen}(x)] \rrbracket_{exh}^{\textit{happen}}$; red ovals (dashed or solid line): $s_0 \llbracket \exists e \exists e' [\textit{unlock}(e) \wedge \textit{happen}(e) \wedge \textit{push}(e') \wedge \textit{happen}(e')] \rrbracket^O$; red solid line ovals: $s_0 \llbracket \exists e \exists e' [\textit{unlock}(e) \wedge \textit{happen}(e) \wedge \textit{push}(e') \wedge \textit{happen}(e')] \rrbracket_{exh}^{\textit{happen}}$.

between the extensions of *happen* in those worlds, and the optimal interpretation of the predicates coincides with their conventional interpretation. (The corresponding $<_{\text{happen}}$ relation on worlds is shown in Figure 6.12) On this assumption, the worlds marked green (dashed or solid line) in Table 6.17 belong to the non-exhaustive update of s_0 with the first sentence *John opened the door* (694a), whereas the solid line green ovals mark the worlds in the exhaustive update. As expected, in all these worlds the opening event is the maximal event that happened, i.e. whatever else happened is part of it.

Assuming that the second sentence *He unlocked it and pushed it* (694b) addresses *the same* relevant question as the first sentence, worlds marked with red ovals in Table 6.17 belong to its non-exhaustive interpretation in s_0 , solid line marking distinguishing the subset that corresponds to the exhaustive update. As Table 6.17 shows, the only world that survives in the exhaustive update with both sentences is w_{22} in the second row of the table, where both unlocking and pushing are part of opening and opening has no other parts, i.e. that's all the opening is about. Thus it is predicted that the relation between the sentence (690a) and each of the conjoined clauses in (690b) is elaboration, whereas sentence (690b) as a whole is a restatement of (690a).

All other relation possibilities mentioned above are ruled out by exhaustification. In the possibilities represented by the third, fourth and fifth row of Table 6.17, the second sentence always introduces an event that is not part of the opening event mentioned in the first sentence, but this is already excluded by the exhaustive interpretation of the first sentence which says that whatever happened must be part of that opening event. This still allows for the possibility in the first row, where both unlocking and pushing form a proper part of opening but the latter also has other parts; however, the exhaustive interpretation of the second sentence only returns worlds where there are no happenings beyond unlocking and pushing, and that contradicts the existence of other components of the opening event. Thus the only reading we get for (690) is that the *only* (relevant) thing John did is opening the door by *only* unlocking and pushing it, and not by also unbarring it or turning the door handle.

Recall that we obtained the same result for the discourse (690) in Chapter 5, thus van Rooij and Schulz' theory of exhaustification makes the same predictions for this case as Groenendijk and Stokhof. Groenendijk and Stokhof's predictions are also replicated for other examples discussed in Chapters 4 and 5. Below I briefly survey these results without going into detail.

First of all, it is worth mentioning again that intonation as well as the presence of other "connecting" devices decide where exhaustification is applied. For the example discussed above, repeated in (695)–(696), it was tacitly assumed that each of the sentences (696a) and (696b) bears a falling completeness intonation. Since there is no other explicit connection between them either, each of the sentences is subject to exhaustive update on its own, cf. (697). By contrast, since the conjoined clauses of sentence (696b) are connected by an explicit conjunction (normally accompanied with a continuation rise on the first conjunct), the sentence is exhaustivized as a whole, rather than on a clause-by-clause basis.

(695) What happened?

(696) a. John opened the door (↘) .

b. He unlocked it (↗) and pushed it (↘) .

(697) $s[[John\ opened\ the\ door]_{exh}^{happen}[[He\ unlocked\ it\ and\ pushed\ it]_{exh}^{happen}$

The same principles are at work in the interpretation of the example (698). Since both sentences bear a completion tune, they are exhaustivized one by one as shown in (699). Again the prediction is that the ski breaking event described in the first sentence and the losing event in the second sentence must be the same event.

(698) Alena broke her skis (\searrow) .
 She lost her main means of transportation (\searrow) .

(699) $s[[Alena\ broke\ her\ skis]_{exh}^{happen}[[She\ lost\ \dots\ transportation]_{exh}^{happen}$

The same pattern is realised in (700a). The “scope” of the completion intonation reflects the scope of exhaustification, cf. (701a). However, the inferred coreference of the bridge building and the plan drawing event contradicts world knowledge which tells us that normally, drawing a plan is one of the many steps in building a bridge, but cannot make up the entire event. Therefore the discourse is predicted to be infelicitous with this intonation. By contrast, in (700b), only the first sentence is uttered with a completion tune, while the second one bears a continuation tune, hence only the first sentence undergoes exhaustive update, whereas the second one is added to the context in a non-exhaustive fashion, cf. (701b). In this case, the second event (drawing plans) is predicted to constitute part of first event (building the bridge), but the reverse is not required (cf. the option in the first row of Table 6.17). Thus this intonation pattern makes the discourse felicitous.

(700) a. # The council built the bridge (\searrow) .
 The architect drew up the plans (\searrow) .
 b. The council built the bridge (\searrow) .
 The architect drew up the plans (\nearrow) ...

(701) a. $s[[The\ council\ built\ the\ bridge]_{exh}^{happen}[[The\ architect\ \dots\ plans]_{exh}^{happen}$
 b. $s[[The\ council\ built\ the\ bridge]_{exh}^{happen}[[The\ architect\ \dots\ plans]^O$

Finally, let’s look at the discourses in (702)–(703). Suppose we make roughly the same assumptions about the semantics of the VPs *watch TV* and *study*, as we did for *open*, *unlock* and *push* in the example discussed above. Then (703a)/(704a) is ruled out on more or less the same grounds as the example (701a) above. By exhaustivizing both sentences separately we infer that the main eventualities, watching TV and studying, must corefer, which is a very unusual situation in the real world. In contrast, the presence of a conjunction and continuation intonation in (703b) and (703c) affects the interpretation in such a way that the coreference requirement does not arise. In (703b) the whole sentence is exhaustivized rather than each of the conjoined clauses separately (cf. the interpretation of *He unlocked it and pushed it* in Table 6.17), whereas in (703c) exhaustive update is not applied at all, and we get a reading that corresponds to the simple conjunction of the literal meanings of the sentences.

(702) What did Kim do?

- (703) a. ? Kim watched TV (\searrow) . She studied (\searrow) .
 b. Kim watched TV (\nearrow) , and (she) studied (\searrow) .
 c. Kim watched TV (\nearrow) , she studied (\nearrow) , ...
- (704) a. $s[[Kim\ watched\ TV]_{exh}^{\lambda e[do(k,e)]}][[She\ studied]_{exh}^{\lambda e[do(k,e)]}]$
 b. $s[[Kim\ watched\ TV\ and\ (she)\ studied]_{exh}^{\lambda e[do(k,e)]}]$
 c. $s[[Kim\ watched\ TV]^O][[she\ studied]^O]$

It should be noted of course that unlike the door opening example, one might want to analyse the meanings of the VPs *watch TV* and *study* as homogenous processes that distribute over their parts. That is for instance, a part of TV watching is itself TV watching, and so on down to indivisible stretches of watching TV, or if there are none, to infinity. However, the analysis of homogeneous processes in the current approach is somewhat more complex and requires additional machinery.⁴⁰ This machinery is incorporated in the formalisation presented in Appendix B, but I will skip the discussion of this issue here.

To conclude, the exhaustification-based analysis of restatement and elaboration can be successfully reformulated in terms of van Rooij and Schulz' (2004b) approach to exhaustive interpretation (with the modifications introduced in the previous sections). Thus Groenendijk and Stokhof's and van Rooij and Schulz' approach produce the same predictions: (a) a strict coreference requirement with sentence by sentence exhaustification; (b) lack of a strict coreference requirement with conjunction or rising intonation; and (c) an incoherence effect where the coreference requirement induced by exhaustification contradicts world knowledge (cf. Chapter 4). However, there is a slight difference in the underlying assumptions. Whereas in Groenendijk and Stokhof's case it was enough to assume that the elements of a restatement are exhaustivized with respect to the same question predicate, in order to infer the coreference effect, in van Rooij and Schulz' setting, we also have to assume that the underlying relevant question, and hence the optimal interpretation of the question predicate, is the same. If this is not the case, $s[[P(x)]_{exh}^P][[P(y)]_{exh}^P]$ does not necessarily entail that x and y refer to the same individual, even though the question predicate symbol P is the same in both updates.

6.7 Last remarks

In the last three chapters I developed a theory of restatement and elaboration based on the notion of exhaustive interpretation. Although the resulting account correctly predicts a restatement relation where two utterances are interpreted as exhaustive answers to the same question, many puzzles still remain unsolved. So far we have only looked at very short discourses used as answers to explicit questions. One might wonder whether the findings based on this material tell us anything about restatement and elaboration in longer discourses, as well as in discourses that are not involved in explicit question answering. Besides, if the

⁴⁰With our definition of exhaustive update, the exhaustive interpretation of *Kim watched TV* where *watch TV* distributes in the same way as *do* or *happen* leads to the wrong prediction that some elementary TV-watching took place. And if it is assumed that *watch TV* and the question predicate P (*do* or *happen*) are both unboundedly divisive, minimisation wrt. $<_P$ will not terminate.

proposed analysis of restatement is right and exhaustivity must be included as an essential component of a general theory of discourse interpretation, rendering the discourse relation of *Restatement* epiphenomenal, what about other implicit relations? Can those also be handled as a reflex of exhaustivity, or is the recourse to discourse relations as ontological primitives inevitable in those cases? All these questions are closely related and will be addressed in the final chapter of this thesis.

However, there are also a number of open and potentially problematic issues of rather specific kinds that will not be taken up in Chapter 7. This section makes a few brief remarks on two such issues. One of them concerns restatements in answers to mention-some questions (Section 6.7.1), which have remained marginal in the discussion so far. Although in general, mention-some questions present a potential problem to the present proposal, I will argue that with some additional assumptions, the approach is not only unproblematic, but also offers a neat explanation for the fact observed in Chapter 4, pp. 163–164, that items of a list may sometimes bear a falling intonation. Then I will briefly return to the issue of the relationship between nominal restatement and nominal apposition. In Chapter 4, Section 4.2.1, I argued that these are two distinct phenomena. In Section 6.7.2, I will present some borderline cases that bear resemblance to both of them, but are neither covered by Potts’ (2005) theory of nominal apposition, nor by the proposed theory of nominal restatement. Some possibilities of extending the current proposal will be discussed.

6.7.1 Mention-some questions and falling intonation lists

It is an established fact that not all questions of the form *Who P?* require an answer that specifies a complete list of individuals having property *P*. Under certain circumstances it is enough to give just one instance of an individual with property *P* to satisfy the interest of the querier. Such questions and answers are called *mention-some* questions and answers, and (705) and (706) are the most well-known examples recurring in the literature (Ginzburg, 1995; Groenendijk and Stokhof, 1997; van Rooy, 2003a). The crucial observation is that answers to mention-some questions such as (705b) and (706b) do not bear an “*and that’s all*” implicature.⁴¹

(705) a. Where can I buy an Italian newspaper?
 b. At the station.

(706) a. Who has a light?
 b. John.

Van Rooij’s context-sensitive notion of exhaustivity captures these cases by assuming that the decision problem behind (705a) and (706a) is such that in some worlds there is more than one optimal action the querier could perform. For instance, in a world where both John and Mary have a light, asking John for a light and asking Mary for a light are equally reasonable things to do. As a result, the relevant question induced by such a decision problem does not represent a partition, the relevance orderings collapse, and more than one optimal interpretation is assigned to the question predicate.⁴² All this ultimately

⁴¹ See Chapter 5, p. 214 for some introductory remarks on mention-some questions.

⁴² Cf. fn. 23 on page 246, as well as the remarks on p. 258.

leads to the desired prediction that e.g. *John* in (706) is not necessarily the only person who has a light, not even within a small restricted domain.⁴³ But this implies that the restatement effect should not show up in answers to mention-some questions. For instance in (708a), if John is not necessarily the only person who has a light and the systems administrator is not necessarily the only person who has a light, then John and the systems administrator need not be the same person, so (708a) should be understood as a list at least on one of its readings. However, with falling intonation on both NPs this reading is hard to get. At least according to my intuitions, the interpretation of (708a) after a mention-some question like (707) is not different from the interpretation it gets in the context of a mention-all question like *Who smokes?*: in both cases the restatement reading seems to be most prominent. (708b) presents further illustration of the same point. If both *John* and *Mary* are mention-some answers, the infelicity of (708b) with the given intonation remains unexplained. In other words, answers to mention-some questions present a case where the proposed theory of restatement appears to overgenerate.⁴⁴

(707) Who has a light?

- (708) a. John (↘) . The systems administrator (↘) .
 b. ?? John (↘) . Mary (↘) .

Of course, one could object that in fact, questions like (705a) and (706a) usually do not ask for just any instance of the question predicate, but for the *best* instance. Thus for example, the answer *at the station* in (705b) bears an implicature that the station is the best place to buy an Italian newspaper (e.g. the closest, the one most likely to be open, etc.), so after all, we have to do with a special kind of mention-all reading (cf. van Rooy, 2003a, fn. 20 on pp. 749–750). On the other hand, one would probably not want to go as far as claiming that best instances are always unique and that genuine mention-some questions do not exist. So we still need a solution for those cases.

Let's first concentrate on the infelicity of (708b), and return to the coreference effect in (708a) later. Suppose the question *Who has a light?* is genuinely mention-some, where John and Mary both “have a light” and moreover, are equally good to be asked for a light. Then the first answer, *John*, already completely resolves the question, and the querier knows what she has to do to get her cigarette lit. But then mentioning *Mary* means giving more information than the querier needs. In other words, (708b) violates Quantity in some sense. Although this alone would not yet explain the coreference effect in (708a), it already gives an idea why (708b) is not completely felicitous.

Furthermore, an independent motivation for this explanation is presented by falling intonation lists. In Chapter 4, pp. 163–164, I already cited de Vries' (2002, p. 214) observation that although asyndetic connection is not typical in lists, it is possible with a kind of “intensification” or “emphasis” effect. It seems to me, however, that this “intensification” effect appears only if each of the list members is uttered with a falling intonation as in (709a). This utterance seems to communicate an implicature “we need much too much.” This implicature seems to be absent in (709b) where the conjuncts bear a rising intonation.

⁴³The reader is referred to van Rooy (2003a) and van Rooij (2004) for details.

⁴⁴I would like to thank Elke Kasimir and Katrin Schulz for drawing my attention to this problem.

- (709) a. We need an office (\searrow), computers (\searrow), money (\searrow).
 b. We need an office (\nearrow), computers (\nearrow), money (\nearrow) ...

Why this could be the case becomes more clear if (709a) is considered in a context like the following:

(710) Why don't we hire more employees?

(711) We need an office (\searrow), computers (\searrow), money (\searrow).
 We cannot hire more employees.

(710) is a mention-some question. The person who asks (710) will perhaps be satisfied by learning just one reason, if that is a *sufficient* reason for not hiring more employees. The speaker of (711) in turn seems to communicate: "We need an office and *this alone* is enough reason for not hiring more employees; we need computers and *this alone* is enough reason for not hiring more employees, etc." In other words, the speaker deliberately violates Quantity, by giving more than one resolving answer to a mention-some question, in order to produce a rhetorical effect which we perceive as "intensification." Thus if we assume that Quantity violation is involved in giving multiple resolving answers to a mention-some question, we can both explain the infelicity of (708b), and the stylistic effects of (709a).

Now what about the coreference effect in (708a)? First of all it should be noticed that given the considerations presented above, (708a) can only be truly felicitous if the answer *John* alone does not completely resolve the relevant question. This could be the case for instance, if the querier needs to know for just one person whether (s)he has a light, but wants that person to be identified both by name and by their job.⁴⁵ Coreference can in turn be inferred if we require that the optimal interpretation *O* of the question predicate *P* during the exhaustive update is the same for both answers *John* and *the systems administrator*, as shown in (712).

(712) $s[[A_1]_{exh}^{O,P} [[A_2]_{exh}^{O,P}$

Identical optimal interpretations of the question predicate as a prerequisite for a restatement reading has already been discussed in Section 6.4.4. However, for mention-all questions the choice between the identical optimal interpretations requirement and the identical relevant questions requirement was not as crucial as here, since a mention-all relevant question determines a unique optimal interpretation function. For mention-some questions this is not the case. And even if *John* and *the systems administrator* answer the same relevant question, it is not yet guaranteed that they are interpreted exhaustively with respect to the predicate *have a light* in the same sense. Therefore (712) is a necessary assumption if we want to infer coreference effects in answers to mention-some questions.

The proposals presented above should be taken as preliminary ideas for approaching the mentioned problems rather than as a finished theory. The

⁴⁵Suppose for instance, that Sue is new in the firm. She already can identify other employees by what they do, but could not yet memorise all their names. Then if Sue learns that the systems administrator has a light, she will know who to address. If she also learns that that person's name is John, she will also know *how* to address him. In other words, a decision problem in which the agents wants to know both who to address for a light, and how to address them, is a decision problem of the appropriate kind.

technical details of the analysis will first have to be fixed, and the empirical basis will need to be clarified. For instance, as was pointed out in Chapter 4, pp. 163–164, the length of the pause between NPs bearing a falling intonation seems to influence whether these NPs are interpreted as a restatement as in (708) or as a list with Quantity flouting as in (709a). Whether this is a consistent distinction and if so, how it can be explained, are still open questions. The investigation of these questions goes beyond the scope of the current study.

6.7.2 Nominal apposition revisited

The next question concerns the role of pragmatics in the analysis of nominal restatements. The last chapters concentrated on the development of an essentially pragmatic account of restatement based on the notion of exhaustive interpretation. Although most of the time the discussion was devoted to restatements formed by two NPs, it should be kept in mind that the ultimate purpose of this study is to develop an account of restatement and elaboration relations between *sentences in discourse*, where NPs were just a handy material for testing the current proposal, since exhaustification of NPs is much better understood than exhaustification of whole sentences. The next chapter will carry on the main theme of the current investigation, leaving NPs behind. But first in this section I will take another look at the relationship between nominal restatement and nominal apposition, and in particular, some border line cases that bear the properties of both.

In Chapter 4, Section 4.2.1, I pointed out multiple differences between restatements and appositions. First of all, by definition restatement was taken to be a sequence of independent utterances. In the case of nominal restatement, the utterances consist of a single NP, which is common in short answers to constituent questions. In contrast, nominal appositions can be linearly (and structurally) embedded in a single sentence, or utterance. Besides, restatements and appositions show different cross-linguistic distribution with respect to the availability of right adjunction, and interact differently with quantification and scope. However, it turns out that there is no perfect correlation between these properties. In particular, the examples below show that constructions with the properties of nominal restatements can be embedded in a single sentence.

First, let's consider right adjunction. Potts (2005) claims that languages like Turkish and Japanese which categorically forbid right adjunction do not have nominal apposition as we know it from languages like English, German, or Russian. Instead of a right-adjoined construction with case repetition, such languages express a similar relationship with left-adjoined structures reminiscent of the English “close apposition” *the cyclist Hasan*, which normally do not involve copying the case marking. Note the case marker *-la* on *Hasan* in the Turkish example below and no case marking on the cyclist.

(713) yarış-tan önce ün-lü bisiklet-çi Hasan-la konuş-tu-k
 race-ABL before fame-ous cycle-ist Hasan-with speak-PAST-we
Before the race we spoke with the famous cyclist Hasan.

In Chapter 4 I have already shown that Turkish also allows for a construction with case repetition in short answers to questions. Example (714) demonstrates that such a construction can also be embedded in the middle of a sentence. Crucially, a comma, or a pause after *cyclist* is obligatory in this case.

- (714) yarış-tan önce ün-lü bisiklet-çi-yile , Hasan-la
 race-ABL before fame-ous cycle-ist-with Hasan-with
 konuş-tu-k
 speak-PAST-we
Before the race we spoke with the famous cyclist, (with) Hasan.

Similarly in Japanese, the base line case is a construction where the left-adjoined dependent element bears genitive case, e.g. *the mayor of Tokyo* in (715), whereas the head gets case dictated by its function in the sentence, cf. dative on *Ishihara Shintaro*.

- (715) Taro-ga Tokyo totizi-no Ishihara Shintaro-ni atta
 Taro-NOM Tokyo mayor-GEN Ishihara Shintaro-DAT met
Taro met the mayor of Tokyo Ishihara Shintaro.

According to my Japanese informant, this sentence becomes ungrammatical if instead of genitive, the dative case is repeated on the *mayor of Tokyo*, and the sentence is uttered “with the same intonation” as (715).

- (716)*Taro-ga Tokyo totizi-ni Ishihara Shintaro-ni atta
 Taro-NOM Tokyo mayor-DAT Ishihara Shintaro-DAT met

However, if an expressed prosodic boundary is inserted between *the mayor of Tokyo* and *Ishihara Shintaro*, the sentence becomes well-formed, cf. (717), although it has a marked effect “as if you were saying the same thing twice.”

- (717) Taro-ga Tokyo totizi-ni , Ishihara Shintaro-ni atta
 Taro-NOM Tokyo mayor-DAT Ishihara Shintaro-DAT met
Taro met the mayor of Tokyo, Ishihara Shintaro.

In other words, in (714) and (717) we have instances of constructions that look like restatements, but are embedded in a sentence like appositions.

The following examples from Russian illustrate the use of quantifiers in a similar construction in sentence-medial position. Recall that if Potts (2005) is right, these could not be instances of nominal apposition, since quantifiers are generally disallowed both as anchors and as appositives. On the other hand, unlike restatements they do not only occur sentence internally, but also need not bear narrow focus, i.e. the main accent in both sentences could fall on *rasxody* ‘costs.’ In other words, reconstructing coreference of *Ivanov, Petrov, Sidorov, Kuznecova, Nikitina and Makarova* and *everyone who submitted their application in time* as an effect of exhaustification of each NP with respect to the question *Who got their travel costs reimbursed last week?* is not immediately motivated. The sentence could just as well occur as an answer to the question *What happened?*

(718) Na prošloj nedele Ivanovu, Petrovu, Sidorovu,
 on last week Ivanov.DAT Petrov.DAT Sidorov.DAT
 Kuznecovoj, Nikitinoj i Makarovoj,
 Kuznecova.DAT Nikitina.DAT and Makarova.DAT
 každomu kto vovremja podal zajavlenie,
 everyone.DAT who.NOM in time submitted application.ACC
 oplatili komandirovočnye rasxody.
 payed.PL travel.ACC costs.ACC

*Last week, Ivanov, Petrov, Sidorov, Kuznecova, Nikitina and
 Makarova—everyone who submitted their application in time—got their
 travel costs reimbursed.*

(719) Ne smotrja na složnuju finansovuju situaciju, každomu
 in spite of difficult financial situation every.DAT
 sotrudniku kotoryj vovremja podal zajavlenie,
 employee.DAT which.NOM in time submitted application.ACC
 Ivanovu, Petrovu, Sidorovu, Kuznecovoj, Nikitinoj
 Ivanov.DAT Petrov.DAT Sidorov.DAT Kuznecova.DAT Nikitina.DAT
 i Makarovoj, oplatili komandirovočnye rasxody.
 and Makarova.DAT payed.PL travel.ACC costs.ACC

*In spite of the difficult financial situation, every employee who submitted
 their application in time—Ivanov, Petrov, Sidorov, Kuznecova, Nikitina
 and Makarova—got their travel costs reimbursed.*

Thus, neither Potts' theory of nominal apposition nor the proposed pragmatic theory of restatement in its current form accounts for these observations. The question arises whether the theory of apposition should be changed to accommodate these cases, or whether the theory of restatement should be extended. In the latter case one might wonder whether the current approach which treats the NPs as two independent utterances answering the same question can still be maintained. I believe that it is worth trying to extend the proposed pragmatic theory. For example, if sentence (718) is reconstructed as (720)/(721), event coreference could be established between (721a) and (721b) via exhaustification with respect to the *What happened?* question, whereas the coreference of NPs could be derived from the assumption that identity of events implies identity of participants in the same role, which is quite standard (see e.g. Bonomi and Casalegno, 1993, p. 13). This would already capture nominal restatements that do not bear narrow focus. Of course, one would still have to provide a mechanism that would merge such pairs of sentences into one with the right surface form.⁴⁶

(720) What happened?

(721) a. Last week, Ivanov, Petrov, Sidorov, Kuznecova, Nikitina and
 Makarova got their travel costs reimbursed.

b. Last week, everyone who submitted their application in time got their
 travel costs reimbursed.

These ideas will not be developed any further in this study. Apart from

⁴⁶This idea is similar to Burton-Roberts' (1975) account of nominal apposition.

the theoretical problems raised by the presented observations, the issue requires a more careful empirical investigation. However, even if further studies force us to adopt a grammatical analysis of (sentence-internal) nominal restatement, it should be kept in mind that the proposed pragmatic theory was developed primarily with the aim to capture restatement as a relation between sentences (or sequences of sentences) in discourse. It is with respect to this goal that the current proposal should be evaluated.

Chapter 7

Towards integrating exhaustivity in a general theory of discourse interpretation

7.1 Questions and results

This study started out with the following questions:

- How are implicit discourse relations inferred?
- Why are implicit discourse relations inferred?

The first question is relatively well studied, and Chapter 2 gave a rather detailed presentation of the solutions proposed in the framework of DRT, and especially SDRT—the most developed formal theory of discourse relations to date. Concerning the second question, there are two major positions in pragmatics. SDRT's answer is: discourse relations (implicit or explicitly signalled) are inferred because *a discourse must be coherent*, and making sense of a discourse boils down to figuring out in which way it is. This idea is formally implemented in the principle *Maximise Discourse Coherence* (MDC) which selects the most coherent one from a set of possible interpretations of a discourse. The discourse relations featured by the winner are thus the ones inferred. The other position, advocated by Relevance Theory and other varieties of post-Gricean pragmatics, is that *a discourse must fulfil its communicative goal*. Thus coherence (and with it, the inference of discourse relations) is not a goal in itself, but a by-product of figuring out in which way a discourse is *relevant*. This idea found expression in a principle that bids you to *Maximise Relevance* (e.g. Sperber and Wilson, 1986). However, only recently has there been a serious attempt to give it an interpretation at a comparable level of formal rigour (van Rooy, 2003b).

In this thesis I have taken up the challenge of developing a formally precise explanation for the phenomenon of implicit discourse relations without stopping

at the level of coherence, but tracing the matter down to the underlying conditions pertaining to the communicative goals of the discourse. Since this is a huge task, I decided to concentrate especially on the following questions:

- Why can some discourse relations remain implicit while others must be signalled explicitly?
- Why do the conjunction *and* and asyndetic connection correlate with different sets of implicit discourse relations?
- Why do different intonation patterns correlate with different sets of implicit discourse relations?

It is obvious that any comprehensive theory of implicit discourse relations will have to answer the first of these three questions. The other two questions are interesting insofar as asyndetic connection, conjunction *and*, as well as intonation all have extremely abstract, almost empty semantics. It is thus not very plausible to assume that any of these devices *signals* discourse relations in a more or less direct way. The connections between the surface form and the inferred relations must be very indirect in these cases, possibly by-passing a whole number of different mechanisms involved in discourse interpretation. Uncovering these connections is therefore likely to shed light on the mechanisms involved, and in the end, on the questions how and why implicit discourse relations are inferred.

Whereas the influence of *and* vs. asyndetic connection on the inference of discourse relations has received a lot of attention in the literature (recapitulated in Chapter 2), our knowledge about the impact of intonation is still relatively scarce. In Chapter 3, I formulated a hypothesis on what this impact could be, supporting it with intuitive examples and the findings of some previous empirical studies on the prosody of spontaneous speech. This hypothesis is summarised again in Table 7.1. The most remarkable part of the hypothesis is, roughly: if two utterances U_1 and U_2 are connected very closely—form a discourse constituent and pertain to the same topic, or question under discussion—then in the *unmarked case* the preferred discourse relations are *Restatement* and *Explanation*. The “unmarked case” is constituted by the combination of asyndetic connection and completion intonation on both utterances: $U_1 (\searrow) U_2 (\searrow)$. The asyndetic connection is obviously the unmarked member in opposition to *and*; the unmarked status of completion intonation (turn-lending, falling, low boundary) as opposed to continuation (turn-holding, rising, high boundary) is a standard assumption in current intonation studies. The proposed hypothesis is therefore remarkable as it assigns the relations of *Restatement* and *Explanation* the most “basic,” unmarked, default status among the implicit discourse relations. This special status needs to be explained, and in particular, the following question must be answered:

- Why does the combination of asyndetic connection with completion intonation give rise to the inference of *Restatement* and *Explanation* between utterances that pertain to the same question under discussion?

In Chapters 4–6, I started developing a theory to answer this question, although I have only been able to answer the part concerning *Restatement* so far:

	Asyndetic connection		<i>And</i>
	$U_1 (\searrow) U_2 (\searrow)$	$U_1 (\nearrow) U_2 (\nearrow)$	
Narration	*	✓	✓
Continuation	*	✓	✓
Parallel	*	✓	✓
Elaboration-proper	*	*	*
Restatement	✓	*	*
Explanation & Co	✓	*	*
Contrast (concession)	*	*	✓
Consequence	*	*	*/✓
Alternation	*	*	*
Purpose	*	*	*

Table 7.1: Implicit realisation patterns of SDRT discourse relations. Legend: ✓ / * indicates that the given discourse relation can / cannot be inferred with the given mode of implicit connection between two utterances that form a discourse constituent and pertain to the same question under discussion.

- Why does the combination of asyndetic connection with completion intonation give rise to the inference of *Restatement* between utterances that pertain to the same question under discussion?

The proposed answer is based on an idea that has long been advocated by Zeevat (see e.g. 1994a), namely: each utterance is interpreted *exhaustively* with respect to the current question under discussion. Given that exhaustive interpretation of answer U to the question *Who/what P?* is, roughly, U is the only thing that P , the *Restatement* relation falls out automatically. If U_1 is the only thing that P , and U_2 is the only thing that P , then U_1 and U_2 must be the same thing. In other words, if U_1 and U_2 are descriptions of an entity (in particular, an event), U_2 re-describes that entity, i.e. *restates* the description presented by U_1 .

Thus only a very small part of the questions raised in this study has received an answer so far. This is the last chapter and it pursues two goals. First, it is intended to sketch out a general theory of discourse interpretation in which the above idea is to be integrated, and in doing so, give informal, tentative answers to the remaining questions. Second, it summarises and draws conclusions from the presented work, discusses its consequences for the study of pragmatics, points out open questions and marks directions for further research.

This chapter is structured as follows. Section 7.2 outlines an approach to pragmatics which could serve as a general framework for the proposal developed in the previous chapters. Section 7.3 addresses the question of the special status of *Explanation* as a “default” discourse relation on a par with *Restatement*. Other discourse relations are considered in Section 7.4, concentrating especially on the role of the conjunction *and* and intonation in directing the inference. It also answers the question why certain relations must be signalled explicitly, while others need not. Finally, Section 7.5 presents the general conclusions of this study.

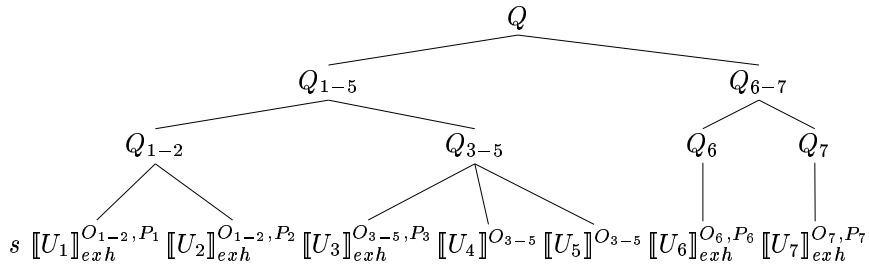


Figure 7.1: Interpreted schematic QUD structure for a sequence of declarative utterances $\langle U_1, \dots, U_7 \rangle$ produced by one speaker, cf. Figure 3.1 in Chapter 3.

7.2 Outline of a theory

A theoretical framework in which the proposal presented in the previous chapters could most naturally be embedded would be largely based on ideas developed by Zeevat (1994a, 2003, 2004), and especially Zeevat (2005). In this section I will only highlight the most essential features of this framework, without going into technical detail.

The interpretation of a discourse—a monologue or a dialogue turn of a single speaker produced without intervention from other discourse participants—is a sequence of optimal exhaustive or non-exhaustive updates of the initial information state s .¹ A schematic example of such a sequence is shown in Figure 7.1.² The desired theory of discourse structure and interpretation is expected to regulate the segmentation of a discourse into basic update units, utterances (e.g. U_1 , U_2 , etc. in Figure 7.1), the choice of optimal interpretation function O and the background predicate P , as well as the choice between the exhaustive $[[\cdot]]_{exh}$ and the non-exhaustive update $[[\cdot]]$.

Starting with the last point, I adopt Zeevat’s (1994a) view of the primacy of exhaustive interpretation, stated as a default principle in (722). The principle says that in the normal case the exhaustive update function $[[\cdot]]_{exh}$ should be applied. This default can be overridden if the utterance contains explicit markers of non-exhaustivity such as the continuation intonation (\nearrow). In the schematic example in Figure 7.1 this would have to be the case in utterances U_4 and U_5 .

(722) *The Principle of Exhaustive Interpretation:*

By default, an utterance is interpreted exhaustively.

The independent linguistic and cognitive motivation for this principle was already presented in Chapter 4, Section 4.3.1. Briefly, there is overwhelming evidence that agents treat the available information, which is necessarily a partial description of reality, as if it were a complete description; interpretation normally involves construction of a *minimal* model that satisfies that description. This makes sense in view of the limited cognitive resources of the humans, and has consequences for a whole range of linguistic phenomena.

¹See Chapter 6, Section 6.4, for definitions of optimal and exhaustive update.

²The QUD structure assigned to the interpreted sequence of utterances $\langle U_1, \dots, U_7 \rangle$ in Figure 7.1 is the same as in the example discussed in Chapter 3, cf. Figure 3.1 on p. 77.

The next variable to be supplied by the theory is the background predicate P , which figures as a parameter of the exhaustive update function. In the previous chapters it was referred to as the “question” predicate, and was derived from the interrogative sentence expressing the question the utterance was supposed to answer by abstracting over the *wh*-elements. In a connected monologue where utterances do not necessarily follow an explicit question, predicate P would be derived from or at least constrained by the information structure of the utterance, and ultimately, its accentual pattern. Roughly, P is the background of U , i.e. U minus its focused constituents. In the case of broad focus, the background predicate must be sufficiently abstract, e.g. *happen*.³ Thus, the predicate P should be supplied by a theory of information structure, which would form part of a theory of discourse interpretation.

The most complex task is, of course, determining the optimal interpretation for each utterance. In van Rooy’s (2003a) theory adopted in Chapter 6, Section 6.4.3, the optimal interpretation function O stands in close connection with the current relevant question, or the question under discussion (QUD), which in turn reflects the domain level goals (the decision problem) of the discourse participants. One of the greatest difficulties this approach has to face is that the domain level goals are not public. The discourse participants usually have highly imperfect information of each other’s communicative intentions. Of course, sometimes the communicative situation and/or an explicit question gives a clue. However, this at best helps determine the root level question, e.g. Q in the abstract example in Figure 7.1,⁴ while the way the speaker decides to split it up into subquestions (Q_{1-5} , Q_{6-7} , Q_{1-2} , etc.), and ultimately the pre-terminal QUDs that determine the optimal interpretation function for each utterance in the case of a multi-utterance monologue, remains largely the speaker’s private matter.

There is one frequently discussed constraint on the hierarchical organisation of questions under discussion which only allows you to split a question Q into an array of subquestions Q_1, \dots, Q_n if giving an answer to each of these subquestions would give an answer to Q . In Groenendijk and Stokhof’s (1984; 1997) terms, the subquestions must jointly *entail* the main question: $Q_1, \dots, Q_n \models Q$. This is the idea implemented in van Kuppevelt’s (1995a, p. 131) dynamic principle of topic termination, Ginzburg’s (1996a) QUD update/downdate mechanism, as well as Roberts’ (1996) and Büring’s (2003) notion of strategy.⁵ This constraint realises the idea of rational planning as applied to discourse. However, it does not get us very far in determining the optimal interpretation functions, as it still allows for too many options for question splitting.

The next group of constraints on the QUD structure is supplied by language itself. Thinking of QUDs as discourse topics, language provides a stock of topic management devices, which were partly surveyed in Chapter 3, Section 3.1.2, under the title of ‘linguistic markers of discontinuity.’ In fact, the information signalled by such devices can be quite elaborate. A major role is played again by

³See Chapter 3, Section 3.1.1, for our assumptions concerning information structure, as well as Chapter 5, Section 5.3.2, specifically on broad focus and *happen*.

⁴For instance, if the monologue $\langle U_1, \dots, U_7 \rangle$ is an answer to an interrogative utterance U_Q , then the semantic interpretation of U_Q would constrain the root question Q of the QUD-structure.

⁵See Chapter 3, Section 3.1.1, for a brief introduction to the QUD-based approach to discourse structure.

information structure, as the placement of focus in an utterance can constrain the local question under discussion in a similar way as an explicitly uttered interrogative constrains the global question. Contrastive topics can also provide information on the question at the second level, above the most local one, along the lines of Büring (2003). Various relationships between utterances and discourse topics can be signalled by discourse particles and conjunctions (see esp. Zeevat, 2003). Finally, global prosodic parameters are involved in topic management, too. For instance, pitch range reset could be analysed as a marker of discontinuity in its purest form, indicating that the current utterance addresses a different local question from that of the previous utterance. Taken together, all these devices give the speaker an opportunity to inform the hearer about his or her way of structuring the global question Q into subquestions.

But what if the utterance contains no marker that indicates its relationship to a previously established topic? In this case the default assumption is that its topic is the same as that of the previous utterance, cf. (723). This assumption will be referred to as the *Principle of Topic Continuity*, which is closely related to a more general continuity principle established in discourse studies at least since Givón (1983).⁶ This principle has found its way into optimality theoretic pragmatics in various forms (see e.g. de Hoop, 2003; Beaver, 2004), and has recently been applied to questions under discussion by Zeevat (2005, cf. the *NEW constraint on topics). On its strongest interpretation, (723) requires the current utterance to address the same local question under discussion as the previous utterance unless there are explicit linguistic cues to the contrary. This implies for the example in Figure 7.1 that such linguistic markers must be present at least in U_3 , U_6 , and U_7 —the points where the local QUD changes. In the absence of such explicit cues, the Principle of Topic Continuity in combination with the Principle of Exhaustive Interpretation constitutes the mechanism that provides *Restatement* readings. Moreover, the principle is also intended to make sure that the information accumulated in the common ground in the course of communication does not automatically update the QUD. Thus even if the previous utterance has settled part of the QUD it addressed, the new utterance addresses the original “unsettled” question unless there is a discourse marker that tells you otherwise. In Chapter 6, Section 6.4.5, it was shown how shared information can affect the QUD and the optimal interpretation function. It was also pointed out that unlimited influence of information is unwanted for a correct account of *Restatement*. This reflects the idea put forward by Asher and Lascarides (2003) that the inference of discourse relations only has access to lexical information or highly conventionalised world knowledge in the common ground, but not the whole load of information communicated by the previous discourse.

(723) *The Principle of Topic Continuity:*

By default, the discourse topic does not change.

⁶Strictly speaking, the original notion of topic continuity in Givón (1983) was restricted to the continuity of discourse referents (participants). *Action continuity* pertained to temporal sequentiality (roughly, *Narration*), and *thematic continuity* to continuity at a more global level of discourse structure—that common something that, for instance, makes a paragraph out of a sequence of sentences. The current notion of Topic Continuity is perhaps conceptually closer to thematic continuity, but in principle at least some other aspects of continuity, e.g. action continuity, are intended to be derivative from it.

Finally, it should be noted that the notion of ‘discourse topic’ in (723) can be understood in a number of ways (even disregarding the view of topic as a prominent referent, as e.g. in Beaver, 2004). One possibility is identifying topics with QUDs (as we have done so far), i.e. partitions of the logical space in the case of mention-all questions, or sets of (possibly intersecting) sets of possible worlds in the case of mention-some questions. Alternatively, (723) could be understood as a direct requirement that the optimal interpretation function remain constant, i.e. ‘topic’ would be equated with ‘optimal interpretation function.’ I argued in Chapter 6 that this might be a more adequate approach if Topic Continuity is intended to explain *Restatement*. First, the constancy of the QUD does not guarantee the inference of *Restatement* in answers to mention-some questions, since these do not determine the optimal interpretation function (see Section 6.7.1). Second, maintaining the QUD is not necessary for the inference of *Restatement* as long as the optimal interpretation remains constant, as was illustrated in Section 6.4.4. In other words, topic as the optimal interpretation function establishes a more coarse-grained equivalence relation on the domain of communicative goals than QUD does, and Topic Continuity based on this weaker notion is sufficient for the analysis of *Restatement*. Moreover, as was suggested in Section 6.4.4, a yet weaker Topic Continuity Principle might suffice—only forbidding the change of the optimal interpretation of the background predicate *P*. In this case, ‘discourse topic’ would be defined as the optimal interpretation of the background.

This study will not make a final choice between these options. First of all, the logical consequences of each definition must be studied more carefully than it has been done here. Second, the analysis of *Restatement* is not the only reason for introducing the Topic Continuity Principle, so other factors should be considered as well before making the final decision. However, the above discussion brings up another important issue, namely, how much we need to know about the speaker’s communicative goals in order to be able to infer implicit discourse relations.

Recall that the above survey of constraints on the QUD structure started out from the need to identify the optimal interpretation functions for utterances in discourse, which we assumed must be supplied by a full theory of discourse interpretation. One might wonder if the proposed constraints will do the job. They might in combination with the knowledge of the overall domain level goals of the speaker (van Rooij’s decision problem), however, as already mentioned, this is the most problematic part as this information is generally not public. Without this knowledge the full specification of the optimal interpretation function is probably impossible. However, I submit that the remaining constraints will be sufficient for the inference of discourse relations.⁷

A formal proof of this statement would require a full formalisation of the theory and cannot be provided here. Instead, I will confine myself to an intuitive illustration. Suppose *A* enters and sees *B* all black and blue and eyes swollen with tears; *A* asks *What happened?*; speaker *B* gives the answer in (724), and *A* eventually notices pieces of broken glass on the floor.

⁷It is possible that the list of constraints will have to be enriched for a full account of discourse relations, however, it should be possible to do without mind reading. All necessary constraints would either reflect general principles of communication and cognition, or be associated with explicit marking.

(724) A: What happened?

B: Fred broke the carafe (↘) . He hit it against the sink (↘) .

Hearing this answer, *A* will probably have doubts whether *B*, unintentionally or deliberately, got his question right. The question *A* had meant was ‘What happened to you that made you weep and caused the bruises?’ The question answered by *B* is apparently ‘What happened such that there is all this broken glass on the floor?’ But in spite of this “misunderstanding,” *A* will be able to infer from *B*’s answer that Fred broke the carafe *by* hitting it against the sink. That is, the inference of a *Restatement* relation between the utterances in (724) does not require sharing the communicative goals and the optimal interpretation function between the speakers.

But this is exactly what would be predicted by the proposed default principles. Suppose the predicate *happen* is interpreted optimally in the sense of ‘What happened such that there is all this broken glass on the floor?’ If Fred breaking the carafe is the only event that created the mess, and Fred hitting the carafe against the sink is the only event that created the mess, these must be the same event. If the predicate *happen* were interpreted in the other sense, the result would be the same. If Fred breaking the carafe is the only event that caused *B*’s bruises, and Fred hitting the carafe against the sink is the only event that caused *B*’s bruises, these must be the same event. In other words, it does not matter what the exact relevant question and the associated optimal interpretation function is. In order to infer *Restatement* it is enough to know that the optimal interpretation is the *same* for both utterances, which follows from Topic Continuity. It should also be possible to reduce the inference of other discourse relations in a similar way to relationships between topics as they are established by general principles and explicit marking, without knowing the actual communicative goals.

This would mean that a highly underspecified representation of the QUDs and the optimal interpretation functions would be sufficient for a theory of discourse relations.⁸ Such representations would be quite different from the full specifications used in this study. However, the pragmatic principles governing the management of such underspecified representations would not be different from the principles for dealing with fully specified communicative goals. The current approach thus provides a reply to Asher and Lascarides’ (2003) criticism of the previous approaches to discourse interpretation based on the recognition of the speakers’ intentions, and at the same time stays in line with the position that discourse coherence is a product of rational, intentional communication. Asher and Lascarides are right that making the inference of discourse relations dependent on the recognition of underlying speaker’s intentions, goals and other ‘private’ features of the participants’ cognitive states introduces unnecessary conceptual and computational complexity into the model. However, rather than taking this as a boundary for the domain of inquest and developing special machinery for dealing with discourse relations, a theory such as that sketched out above would predict exactly this without introducing any special machinery. In other words, once appropriately developed, it would constitute a reinterpretation of SDRT in the spirit of Grice and Relevance Theory.

⁸Of course, richer specifications might be needed for the inference of other implicatures.

7.3 *Restatement and Explanation*

The approach to discourse interpretation sketched out in the previous section includes two default principles: the *Principle of Exhaustive Interpretation* (722) and the *Principle of Topic Continuity* (723). These are the principles that account for the inference of *Restatement* in the unmarked case, i.e. where asyndetic connection is combined with completion intonation—a *Restatement* relation is established where neither of the defaults is violated.⁹ However, I argued in Chapter 3 that *Restatement* shares this unmarked, default status with *Explanation*, cf. Table 7.1. The intention is that *Explanation* should also be inferred in cases where both default principles apply, but it is still far from obvious how this would follow from the theory developed in Chapters 4–6. So far it seems that the only relation predicted for $U_1 (\searrow) U_2 (\searrow)$ is coreference between the main eventualities of the sentences, so *Explanation*, which does not involve such coreference, is excluded like any other relation.

This section discusses some possibilities of extending the current approach to account for *Explanation* as another consequence of the default principles on a par with *Restatement*. Section 7.3.1 considers some relevant ideas expressed in the literature which motivate various ways of weakening the Topic Continuity Principle. Section 7.3.2 presents an attempt to derive *Explanation* while maintaining strong Topic Continuity as formulated in Section 7.2 above. It concentrates on causal *Explanations* supported by causal relations encoded in the lexicon.

7.3.1 Possible approaches to *Explanation*

To recapitulate the problem, consider the example in (725). The utterances in *B*'s answer are connected asyndetically, do not contain any discourse markers and are both realised with the completion intonation (\searrow). This is the unmarked case, thus both default principles will apply. The Principle of Topic Continuity requires that the utterances be interpreted as answers to the same question,¹⁰ and the Principle of Exhaustive Interpretation makes these answers exhaustive. Consequently, Max falling must be the only relevant event that happened, and John pushing him must be the only relevant event that happened, therefore, they must be the same event. But the nature of pushing and falling and the actual interpretation of (725) suggests the contrary. First of all, pushing in (725) is understood as temporally prior to falling, and events that cover distinct time spans cannot be identical. In other words, the predicted event coreference would miss the correct reading of the discourse. Second, pushing and falling involve distinct sets of participants: whereas pushing involves both John and Max, falling is done by Max alone. If we enforce the identity of participants as a necessary prerequisite for event identity then the events in (725) may not corefer, and the discourse is predicted to be infelicitous.

(725) A: What happened to Max?

B: Max fell (\searrow) . John pushed him (\searrow) .

⁹This extends to *Elaboration*, too. Recall that on the current definition of *Restatement*, *Elaborations* are either identical with *Restatements* or inferred simultaneously with a *Restatement* as its part, cf. Chapter 3, pp. 101–103.

¹⁰For ease of presentation, topics will again be identified with questions under discussion rather than optimal interpretation functions or abstractions thereof.

Looking at related ideas circulating in the literature, the first strategy for solving this problem that comes to mind is to relax the Principle of Topic Continuity. Indeed, the requirement that the question under discussion remain *completely* unchanged might appear too strong. The question is then, what kinds of changes should be allowed.

The most straightforward approach that would immediately accommodate *Explanation* readings is to allow the next utterance to address a *why*-question:

(726) *The Principle of Topic Continuity* (weak version 1):

In a sequence of two adjacent utterances $\langle U_1, U_2 \rangle$,

by default, one of the following holds:

a. U_2 addresses the same question as U_1 does; or

b. U_2 addresses the question *Why U_1 ?*

This looks *ad hoc* at first glance: why should *why*-questions be granted such a special status? However, this move could be motivated from the cognitive perspective. There is overwhelming evidence that causal relations play an exceptionally important role in the humans' representation of the world (see Carston, 2002, pp. 235–242, for extensive discussion). As Carston puts it, the humans are “explanation seeking creatures,” so it is not surprising that “taking the second utterance as explanatory of the first is simply the first strategy tried.” In the current approach this would be one of the two “first strategies” on a par with Topic Continuity in the narrow sense.¹¹

Another possible approach could be based on the idea proposed by Cooper (2003, p. 372) that the difference between discourse subordination and coordination could be construed in terms of what issue is addressed by the second utterance. For subordinating discourse relations (i.e. *Explanation*, *Elaboration*, *Restatement*, etc.), this issue is whether the first utterance is true. Referring to Ginzburg (1996a,b), Cooper assumes that the question “whether it is true” can be activated by *any* utterance, i.e., presumably, it need not be triggered by any special markers. If this is right, then introducing such questions can be viewed as another candidate for a default, unmarked strategy, cf. (727).

¹¹In fact, Carston (2002) intends causality to be *the* default principle, whereas at least some of the *Restatement/Elaboration* readings would be construed as *Explanations*. Carston adopts Aristotle's division of ‘four causes’: the formal, the material, the final, and the efficient. *Explanations* based on formal and material causes would easily fall into the category of *Restatements* in our current sense:

(i) *Formal explanation:*

The chicken crossed the road.

She was on the east side at 2.00 and by 2.10 she was on the west side.

(ii) *Material explanation:*

The chicken crossed the road.

She hopped like crazy for ten minutes.

Reducing *Restatements* to *Explanations* rather than the other way round is an elegant idea. Another interesting question that can be raised in this connection is whether Topic Continuity should also be derived from a more general principle of Causality. However, Carston's idea of causality is not intended to cover all the cases that are currently accounted for in terms of Continuity, so we will not explore this issue any further here.

(727) *The Principle of Topic Continuity* (weak version 2):

In a sequence of two adjacent utterances $\langle U_1, U_2 \rangle$,

by default, one of the following holds:

a. U_2 addresses the same question as U_1 does; or

b. U_2 addresses the question whether U_1 is true.

It seems at least that this extension would capture *Explanations* of type *Evidence*. Asking whether U_1 is true is appropriate especially when there are reasons to doubt U_1 , that is, the speaker assumes that the hearer has reservations immediately accepting U_1 , or in other words U_1 cannot be grounded. That is why the question “whether U_1 is true” is raised, and the immediately following utterance U_2 is understood as support for the claim. Indeed, this is the type of communicative situation in which *Evidence* is called for.

These ideas will not be explored any further in this study. In fact I believe that before adopting one of the above proposals it is at least worth trying to derive *Explanation* readings without weakening the Topic Continuity principle. Once a mechanism for grounding failure is introduced into the model, *Evidence* could probably just as well be construed as resulting from answers to the same question. If U_1 cannot be grounded, it has *prima facie* no effect on the common ground (the information state). This has at least two consequences: (a) the question under discussion that U_1 was supposed to address remains unanswered; (b) neither U_1 's conventional content nor its exhaustive implicatures are added to the information state. Thus if U_1 is a description of an eventuality, the resulting information state will not necessarily entail that that eventuality is the only relevant one. Hence, U_2 may introduce a distinct event, but it still has to address the original question and produce the effect originally intended to be produced by U_1 . The latter is only possible if there is some kind of logical connection between the two statements (U_1 follows from U_2), or a causal connection between the described eventualities.

For reasons of space it is not possible to amend the current proposal with a full-fledged grounding mechanism in order to formalise the above idea. Therefore I will next concentrate on a different class of *Explanation* relations which do not require such a mechanism. The next section is devoted to causal *Explanations* supported by causal relations encoded in the lexicon. It will be shown how these could be captured by the current theory while maintaining the Principle of Topic Continuity in its strong version (723).

7.3.2 Causal *Explanations* supported by the lexicon

The relevant class of *Explanation* relations was discussed in Chapter 2, pp. 49–53, and (728) presents a typical example. Recapitulating briefly, the inference of such relations in SDRT is based on the idea that the lexical entry of some expression (usually, the main verb) in at least one of the sentences introduces two eventualities connected by a causal relation, e.g. in the case of *push*, the event of applying physical force to an object and the resulting movement to which that object is set. Then establishing a causal relationship between the sentences boils down to establishing a coreference relation between one of these eventualities and the main eventuality of the other sentence. Thus in (728), the falling eventuality of the first sentence is identified with the movement caused by pushing.

(728) A: What happened?

B: Max fell (\searrow) . John pushed him (\searrow) .

The main question is then what forces us to establish coreference between the movement eventuality introduced implicitly by the lexical entry of *push* and the falling eventuality of the first sentence. Asher and Lascarides (2003) derive this from the *Maximise Discourse Coherence* (MDC) principle: the movement eventuality in *push* is assumed to behave largely like an anaphoric pronoun, and MDC bids you to resolve as many anaphoric links as possible. In this section I present an illustration of using the lexicon in a similar way, but establishing event coreference via Topic Continuity and Exhaustification. These principles are intended to play the same role as they do in the inference of *Restatement*, so Topic Continuity will be applied in its strong version (723).

To begin with, the lexical entry of *push* will be assumed to provide a definition which equates pushing with applying physical force by an agent x to an object y which *causes* that object to move in a particular way (e.g. away from x). In other words, whenever pushing takes place, the causation of this kind of movement takes place as well, and *vice versa*. In the current setting, this idea could be captured by a meaning postulate such as (729).¹²

(729) The “force movement” property of *push*:

$$\begin{aligned} \forall e, x, y [[push(e, x, y) \wedge happen(e)] \leftrightarrow \\ \exists e' [cause(e, e') \wedge agent(e, x) \wedge move(e', y) \wedge happen(e')]] \end{aligned}$$

The crucial consequence of (729) is that whenever a pushing “happens” a movement “happens,” too, and whenever movement of a certain type caused by an agent takes place, pushing takes place as well. Since meaning postulates play the role of constraints on the initial information state s_0 , worlds where only one type of eventuality happened but not the other would be excluded from s_0 . Therefore minimising the extension of *happen* will not get us below this boundary.

For example, suppose the sentences in (728) are analysed as $\exists e [fall(e, m) \wedge happen(e)]$ and $\exists e [push(e, j, m) \wedge happen(e)]$, respectively. The initial information state s_0 is updated exhaustively with each sentence, the background predicate is *happen* in both cases, and the sentences are interpreted with respect to *the same* optimal interpretation function O (as a consequence of strong Topic Continuity), cf. (730). For simplicity, it will be assumed that the optimal interpretation equals the conventional interpretation function in both cases, $O = F$, therefore the simple relevance-independent version of exhaustive update $[\cdot]_{exh}^P$ is used in (730) instead of $[\cdot]_{exh}^{O,P}$.

$$(730) s_0 [[\exists e [fall(e, m) \wedge happen(e)]]_{exh}^{happen} [[\exists e [push(e, j, m) \wedge happen(e)]]_{exh}^{happen}]]$$

Table 7.2 presents a fragment of a model illustrating the effect of (730) and its interaction with the postulate (729). Suppose the domain contains just three eventualities, e_1 , e_2 , and e_3 ,¹³ and suppose that in all worlds represented in Table 7.2, e_2 causes e_1 , whereas e_3 is not causally connected to either eventuality.

¹²The formulation in (729) disregards certain details such as the particular kind of movement and the fact that causation has to involve applying physical force. The correct complete version of this meaning postulate would have to include this information in order to validate the biconditional “ \leftrightarrow .”

¹³Complex events like $e_1 \oplus e_2$, $e_1 \oplus e_2 \oplus e_3$, etc., are ignored for the present purposes.

	<i>happen</i> \mapsto						
	$\{e_1, e_2, e_3\}$	$\{e_1, e_2\}$	$\{e_1, e_3\}$...	$\{e_2\}$	$\{e_3\}$	\emptyset
<i>fall</i> $\mapsto \{e_1\}$ <i>move</i> $\mapsto \{e_1\}$ <i>push</i> $\mapsto \{e_2\}$...		w_{17}	w_{18}
<i>fall</i> $\mapsto \{e_3\}$ <i>move</i> $\mapsto \{e_1, e_3\}$ <i>push</i> $\mapsto \{e_2\}$...			w_{28}

Table 7.2: The worlds in the body of the table represent a subset of the initial information state s_0 . For each world in the given subset, the conventional interpretation $F(happen)$ in that world is given in the heading of the corresponding column, the values of $F(\lambda e[fall(e, m)])$, $F(\lambda e[move(e, m)])$, and $F(\lambda e[push(e, j, m)])$ in the corresponding row. It is assumed that in all worlds: (a) e_1 is caused by e_2 , $cause(e_2, e_1)$; (b) no other causal relations hold; (c) John is the agent of e_2 , $agent(e_2, j)$. The marked worlds represent the following propositions: green ovals (dashed or solid line): $s_0[\exists e[fall(e, m) \wedge happen(e)]]$; green solid line ovals: $s_0[\exists e[fall(e, m) \wedge happen(e)]]_{exh}^{happen}$; red ovals (dashed or solid line): $s_0[\exists e[push(e, j, m) \wedge happen(e)]]$; red solid line ovals: $s_0[\exists e[push(e, j, m) \wedge happen(e)]]_{exh}^{happen}$.

The rows of Table 7.2 represent two relevant cases. In the worlds of the first row, the falling and the movement caused by pushing are instantiated by the same eventuality e_1 ; in the worlds of the second row, falling is instantiated by e_3 which is causally independent of e_2 , i.e. John pushing Max causes some other movement e_1 , but not Max falling. Note that since in all the represented worlds e_2 belongs to the extension of $\lambda e[push(e, j, m)]$, and e_1 to the extension of $\lambda e[move(e, m)]$, and it is assumed that John (j) is the agent of e_2 in all these worlds, the meaning postulate (729) rules out worlds such as w_{13}, \dots, w_{16} and w_{23}, \dots, w_{26} from the initial information state. Obviously, in all such worlds either the cause or the effect of pushing happened, but not both, i.e. either e_1 but not e_2 , or e_2 but not e_1 , which is inconsistent with the biconditional in (729). This has an immediate effect on the exhaustive interpretation. For instance, the worlds highlighted green in Table 7.2 are included in the normal, non-exhaustive interpretation of *Max fell*. Minimising the extension of *happen* among the worlds of the second row will yield w_{27} , the world where Max falling is the only eventuality that happened. However, minimising *happen* in the first row will not lead to the same result since it is precluded by the meaning postulate. Worlds where only e_1 happened are not there. Therefore minimisation will only go as far as w_{12} where both the falling of Max happened and its cause e_2 . For the same reasons, the minimisation of *John pushed Max* (red in Table 7.2) with respect to *happen* will only contain worlds like w_{12} and w_{22} (red solid line):

$$(731) \text{ a. } \min_{<_{happen}}(s_0[\exists e[fall(e, m) \wedge happen(e)]]) = \{w_{12}, w_{27}, \dots\}$$

$$\text{ b. } \min_{<_{happen}}(s_0[\exists e[push(e, j, m) \wedge happen(e)]]) = \{w_{12}, w_{22}, \dots\}$$

The exhaustive update of s_0 with both sentences, (730), is a subset of the intersection of their exhaustive interpretations in s_0 , $\{w_{12}, w_{27}, \dots\} \cap \{w_{12}, w_{22}, \dots\}$, so it will only contain worlds such as w_{12} , where Max fell, John pushed him, the pushing caused the falling, and nothing else happened.¹⁴ This is exactly the desired outcome—the resulting information state entails a causal relation between the main eventualities of the sentences in (728).¹⁵ Roughly speaking, the mechanism of exhaustive interpretation with respect to the same topic gives us the strongest interpretation consistent with the meaning postulates. This realises essentially the same idea as that behind the *Maximise Discourse Coherence* principle in the SDRT analysis of such examples. However, in the current setting, the same result is achieved by exhaustification, which can be viewed as a formal implementation of *Maximising Relevance* in the spirit of Grice and Relevance Theory (van Rooij and Schulz, 2004b; van Rooy, 2003b).

But the analysis sketched out above also has some obvious limitations. For instance, it would presumably provide different predictions if the background predicate were *happen at time T*, rather than just *happen*. The fact that a pushing happened at time T does not entail that the movement caused by it happened at time T as well. On the contrary, the latter would most certainly have happened after T . But if this cannot be inferred then worlds like w_{13} and w_{16} would not be ruled out from s_0 , cf. Table 7.2, and without this the same inference would not go through. Therefore, the presented analysis should be viewed primarily as an illustration for an idea. A final proposal along these lines would require further investigations.

To summarise, in this section I presented some ideas on how *Explanation* could be derived as a “default” discourse relation on a par with *Restatement*. “Default” means in this case that these relations are established where neither of the proposed default principles—the Principle of Exhaustive Interpretation and the Principle of Topic Continuity—is violated. I have considered various ways

¹⁴Since the individual updates do not give rise to dynamic effects in the current example, (730) equals the intersection of $\{w_{12}, w_{27}, \dots\} \cap \{w_{12}, w_{22}, \dots\}$, cf. Chapter 6, Section 6.3.3.

¹⁵A few remarks need to be made in connection with this inference. Firstly, the resulting information state would of course also include worlds where the falling is identified with the pushing act rather than the movement forced by that act, unless this is excluded by another meaning postulate. Such a postulate would be easy to motivate though, for instance, if assumed that an action involving a volitional agent may not be identical with an eventuality that does not involve an agent.

Secondly, it is obvious that the above inference would go through in just the same way if the order of the sentences were reversed: *John pushed Max. He fell*. In this case, the inferred discourse relation would be *Result*. It was already mentioned in Chapter 3, fn. 32 on pp. 97–97, that *Result* shows hybrid behaviour, sometimes patterning with subordinating relations like *Elaboration* and *Explanation*, and sometimes with coordinating relations like *Narration*. It is possible that the aspects of *Result*'s behaviour in which it is similar to subordinating relations could be captured by the current account. However, this issue requires more careful investigation.

Thirdly, it should be noted that an important role in the above inference is played by the *ceteris paribus* condition in the definition of $<_P$, cf. (564) in Chapter 6, p. 218, which ensures that only those worlds are comparable according to $<_P$ in which the extensions of all other expressions except P are the same. In the above example the predicates whose extensions had to be kept constant included *fall*, *push*, *move*, as well as *cause*. This is what allowed us to minimise the extension of *happen* within the boundaries of one row of Table 7.2. If the worlds were comparable across rows, then e.g. $w_{27} <_{\text{happen}} w_{12}$ would hold, so w_{12} would not be minimal and hence would not survive in the exhaustive update of s_0 with *Max fell*. The successive exhaustive interpretation of both sentences would then be empty, and the discourse predicted to be inconsistent.

of weakening Topic Continuity motivated by proposals in the literature. However, I have also tried to show that it is at least worth an attempt to extend the current analysis to *Explanations* while maintaining strong Topic Continuity. Closer investigation of this possibility remains a task for future research.

7.4 Other discourse relations

One of the implications of the proposed approach to discourse interpretation is that all discourse relations other than *Restatement* (including *Elaboration* as part) and *Explanation* are “non-default.” That is, the inference of such relations either involves a violation of the Principle of Exhaustive Interpretation (722), or the Principle of Topic Continuity (723). This section provides a very partial discussion of such relations, concentrating primarily on aspects of the following issues:

- Why can some discourse relations remain implicit while others must be signalled explicitly?
- Why do the conjunction *and* and asyndetic connection correlate with different sets of implicit discourse relations?
- Why do different intonation patterns correlate with different sets of implicit discourse relations?

In the strongest version of the current proposal the effects of the default principles can only be switched off by the presence of specific linguistic devices: either what was called explicit markers of discourse relations in Chapter 2, or at least, such weak markers as continuation intonation or the conjunction *and*. Thus the answer to the last two questions reads roughly: because the conjunction *and* and continuation intonation influence the application of the default principles, whereas asyndetic connection and completion intonation do not. This property of intonation and conjunction is reconsidered in Section 7.4.1. Section 7.4.2 discusses selected issues related to the inference of specific non-default discourse relations, and in particular, addresses the first of the above questions.

7.4.1 Signalling devices

Various kinds of linguistic devices that are involved in signalling discourse relations other than *Restatement* and *Explanation* were discussed at length in Chapters 2 and 3. One major group is constituted by expressions that directly encode a particular relation or group of relations, e.g. *then* for temporal sequence (*Narration*), cf. Section 2.1.1. Another group includes topic management devices discussed above and in Section 3.1.2. These bear information on the topic structure in the neighbourhood of the current utterance, which in turn can indirectly affect the inference of discourse relations. I will not return to these groups and as usual, will only concentrate on two expressions—continuation intonation and conjunction *and*. A proposal towards their semantic analysis was formulated in Chapter 5, Section 5.5. In this section it will be reconsidered briefly in light of the pragmatic framework sketched out in Section 7.2 above.

Continuation intonation

The most straightforward analysis of continuation intonation would treat it as a signal that the utterance is not complete yet. In this sense it would be just an indicator of the segmentation of the discourse flow into elementary update units.¹⁶ A constituent bearing a continuation tune would thus only form part of an elementary unit, and hence would not undergo update of any sort—either exhaustive or non-exhaustive. If the syntactic structure of that constituent allows for an interpretation as a complete utterance (roughly corresponding to a turn construction unit, TCU, in conversation analysis) then the continuation intonation would prevent such an interpretation, and keep the structure open for further syntactic attachment.

This analysis was adopted in Chapter 5, Section 5.5.2, for one subclass of continuation tunes—those that indicate that a completion is to follow soon. This subclass is distinguished melodically from other kinds of continuation at least in Russian and German (see Chapter 3, pp. 136–137), and we will probably find a similar distinction in many other languages, although the issue needs more careful investigation.

However, this analysis is hard to maintain for all types and all occurrences of continuation intonation, since there are more or less conventionalised usages of (↗) on units that are not intended to be intonationally completed soon or at all. This is the case, for instance, in clause (c) of examples like (732)/(733) below, and corresponds roughly to “...” in writing. In this case, the continuation tune indicates that the list could continue forever in the same way, so the hearer is forced to interpret the utterance ‘as is,’ without waiting for a completion.

- (732) a. Roman ždet ego v sadu (↘) .
Roman is waiting him in garden
b. On guljaet (↗) ,
he is walking
c. smotrit na derev'ja (↗) ...
is looking at trees
- (733) a. Roman is waiting for him in the garden (↘) .
b. He is walking (↗) ,
c. looking at the trees (↗) ...

In Chapter 5, this type of continuation intonation (which is associated with a distinct melody in languages like Russian and German) was analysed as a signal that the utterance should be interpreted non-exhaustively, i.e. in our current terms, it should be subject to *non-exhaustive update*, $[[\cdot]]^O$. In other words, this is a device that will override the default Principle of Exhaustive Interpretation (722).

However, in the setting outlined in Section 7.2 there is an alternative way of dealing with continuation intonation of this type—it could be treated as another topic management device. Rather than saying that utterance U is a non-exhaustive answer to question Q , one would say that U is an answer to a particular kind of subquestion of Q . For instance, the QUD *Who came*

¹⁶Recall that this is one of the parameters that should be regulated by a complete theory of discourse structure and interpretation based on the principles outlined in Section 7.2, cf. p. 289.

to the party? would be split into a series of subquestions *Who, for example, came to the party?, And who else?, And who else?, etc.*¹⁷ Under this approach, the utterances bearing (\nearrow) can again be treated as exhaustive answers, but to distinct questions. In other words, the function of (\nearrow) is reconstructed as signalling violation of Topic Continuity, rather than Exhaustivity.

This approach has some advantages over the one based on non-exhaustive interpretation. Whereas topic management and the violation of Topic Continuity are needed for the analysis of a whole range of other expressions, it seems so far that non-exhaustivity is introduced only for the treatment of continuation intonation. But if all the effects of non-exhaustivity can be recast in terms of topic management, such an analysis would be preferable from the point of view of theoretical parsimony. Exhaustive Interpretation could then be promoted to an unviolable principle.

The discussion of this issue will be left at this. As long as we stay within the “black box” view of semantic and pragmatic interpretation, these approaches remain equivalent. However, if the current notion of update and topic management correspond to anything that humans actually do during discourse processing, then non-exhaustive update could possibly be distinguished from exhaustive update associated with a topic change. Therefore the final choice should be left until more can be said on the cognitive relevance of the whole framework.

Conjunction *and*

The analysis of *and* presented in Chapter 5, Section 5.5.1, assigns it a standard meaning, ambiguous between the Boolean \wedge and the non-Boolean conjunction \oplus , and type-shifted versions thereof. In the previous chapters, I simply followed Carston (1993) in assuming that *and* makes one sentence (utterance) out of two, and in doing so puts the whole of it in the scope of a single (exhaustive) update operator. The pragmatic differences between conjoined and asyndetically connected sentences were accounted for as differences between $s[\phi \wedge \psi]_{exh}^{O,P}$ and $s[\phi]_{exh}^{O,P} [\psi]_{exh}^{O,P}$, respectively. In light of the analysis of continuation intonation presented above, this would in any case be the appropriate strategy for dealing with the occurrences of *and* that follow an utterance-internal rise, i.e. continuation intonation that signals an incomplete utterance. But what if the previous material has already been processed as a complete utterance, i.e. has undergone exhaustive (or non-exhaustive) update?

In the framework outlined in Section 7.2, utterance-initial *and* could be handled straightforwardly as a topic management device. It would be assigned roughly the same meaning as the utterance-final (\nearrow) on its topic-based analysis. That is, *and* would signal that the topic of the current utterance is part of a *What, for example, P? What else? What else?* strategy. The only difference would be that whereas (\nearrow) indicates a relationship between the topic of the current utterance and the subsequent one, *and* relates the topics of the current and the previous utterance. In sum, utterance-initial *and* is another overrider

¹⁷More formally, the optimal interpretation functions for each utterance bearing the “open list” rise would relate to each other in the same way as the optimal interpretation functions induced by a mention-some question. Recall that a mention-some question gives rise to multiple optimal interpretations, cf. Chapter 6, Section 6.7.1. Thus (\nearrow) would indicate that the next utterance should be interpreted with respect to a *different* interpretation function from that set.

of Topic Continuity. At first glance, this approach contradicts the standard view that *and* maintains the same topic, cf. e.g. Schiffrin (1987), Zeevat (2003, p. 106), however, the conflict is only apparent. In the present approach, *and* only indicates a change of the *most local* topic, but the nature of the strategy signalled by *and* implies maintenance of the topic at the second level.

The above accounts of utterance-internal and utterance-initial *and* both make sure that the interpretation of conjoined sentences is compatible with discourse relations other than *Restatement* and *Explanation*. However, the mainstream view, which was recapitulated in detail in Chapter 2, associates *and* with a stronger effect. It is standardly assumed that subordinating discourse relations such as *Restatement* and *Explanation* are in fact *precluded* by the presence of *and*, cf. the stars in the third column of Table 7.1. In Chapter 2, I discussed some problems faced by a simple approach that directly associates *and* with a prohibition of subordinating discourse relations, such as Txurruka (2003), and argued that the facts on which this generalisation is based first need to be re-examined more thoroughly. Nevertheless, there definitely are cases that give rise to clear intuitions, such as (734) below, where the insertion of the conjunction *and* in (734b) makes the “backwards causal” relation (*Explanation*) hard to access. Of course, this fact will have to be accounted for sooner or later.

- (734) a. Max fell. He slipped on a banana peel.
 b. Max fell *and* he slipped on a banana peel.

On the face of it, this effect could probably be attributed to *blocking* in the sense of bidirectional Optimality Theory (Blutner, 2000). The idea is that the search for an optimal interpretation of an expression is counterbalanced with the search for an optimal expression of a particular meaning. Thus if the speaker could have used a simpler (less effortful) expression f' to convey meaning m , he or she would not have used expression f instead—therefore interpretation m is *blocked* for f . Something similar could be going on in examples like (734): since a *Restatement/Explanation* relation could have been conveyed by the version without *and* (734a), this reading is excluded for the *and*-version (734b).

The formal realisation of this idea will have to await another occasion. In the van Rooij-style OT adopted in this study, one would presumably have to define an appropriate measure of effort, as well as make sure that multi-utterance expressions can be compared for optimality. Further exploration of this solution remains a task for the future.

7.4.2 Remarks on the inference of non-default relations

Many interesting proposals on the inference of various discourse relations in a framework similar to the current one were formulated by Zeevat (2003, 2005). For reasons of space detailed discussion of the whole range of relevant relations cannot be provided. Therefore, I will only concentrate on points in which our proposal either extends or differs from Zeevat's. First, a brief look will be taken at *Narration*, which receives a rather unusual interpretation in the present approach. After that, I turn to non-veridical relations and the “denial of expectation” type of *Contrast*, and discuss the question why these must be signalled explicitly.

Narration, and other coordinators

In this study I have promoted a rather unorthodox view of *Narration* based on non-standard empirical assumptions, therefore this relation deserves some special attention. Traditionally, *Narration* has been viewed as *the default* discourse relation, it has always been assumed to be conveyed most readily both by sequences of asyndetically connected and of conjoined sentences, both with and without expressions signalling temporal sequence explicitly. The *Narration* default is one of the phenomena originally intended to be captured by the continuity principle (cf. *action continuity* in Givón, 1983), and this is exactly what Zeevat's (2005) conception of this principle is supposed to provide. In the current setting, Topic Continuity will also play an important role. Nevertheless, *Narration* is construed as a non-default discourse relation in the sense that it either involves a violation of Exhaustivity, or a violation of Topic Continuity at the first, most local level of the QUD structure (whereas Continuity is maintained at the second level).

This approach implies that *Narration* cannot be inferred between asyndetically connected sentences uttered with a completion intonation, $U_1 (\searrow) U_2 (\searrow)$, since no expressive device is present here that would switch off Exhaustivity or Topic Continuity, hence both principles apply and either *Restatement* or *Explanation* must follow. One could think of weakening this effect by allowing the hearer to reanalyse the utterances as locally pertaining to distinct topics, rejoining them at the second level of the QUD structure, if the encoded meaning of the sentences plus the associated world knowledge contradict the *Restatement* or *Explanation* interpretation. Then roughly, U_1 could be construed as an answer to *What happened first?* and U_2 as an answer to *What happened then?* or *What else happened?*, which are dominated by the same topic *What happened?* at the next level. This would allow for *Narration* readings as well as other coordinating relations, although such reanalysis should be associated with at least a small penalty, to account for the mildly suboptimal character of (735), as well as the hypothesised preference for expressing *Narration* by continuation intonation or conjunction *and* in spontaneous speech (cf. Chapter 3).¹⁸

(735) A: What did Kim do today?

B: ? Kim watched TV (\searrow) . She studied (\searrow) .

The best, perfectly felicitous *Narrations* and other coordinating relations would then be obtained either by using continuation intonation that signals a violation of Exhaustivity, or by using *and* that signals a local violation of Topic Continuity, as outlined in the previous section.¹⁹ The usage of these devices

¹⁸In written language, the perfect felicity of *Narration* with asyndetically connected sentences ending in a period could be approached in a number of ways. One way is to assume that intonation is completely underspecified in writing, so the reader is free to reconstruct such a sequence as a sequence of continuation rises $U_1 (\nearrow) U_2 (\nearrow)$. However, this assumption might turn out problematic in light of recent findings on punctuation and silent prosody (see e.g. Hirotsani et al., 2006). Another approach would be to introduce an additional constraint that associates a penalty with the usage of sentence-initial *and* (cf. the discussion of Dorgeloh, 2004, in Chapter 3, pp. 112–114). If this penalty outweighs that of reanalysis, asyndetically connected sentences ending in a period reanalysed in terms of local topic discontinuity will win the race after all. This solution would require the integration of style in the calculation of optimal form-meaning pairs.

¹⁹Of course, explicit markers such as *then* or *after that* for *Narration*, or *at the same time* for *Parallel* can also be used, in addition or instead.

would license the inference of coordinating relations like *Narration* and *Parallel*, but of course, it will not distinguish between them. Why either relation would be preferred in each particular case is an independent question. However, an essential role in making this distinction is probably played by the long forgotten aspectual opposition between punctual and durative eventualities, as in the Russian examples (736) and (737).

(736) Punctual + punctual, temporal succession (*Narration*):

On sel i zapel
 he sat-down.PERF and sang.PERF
He sat down and (then) started singing.

(737) Durative + durative, temporal overlap (*Parallel*):

On sidel i pel
 he sat.IMPERF and sang.IMPERF
He was sitting and singing.

One of the main reasons why the idea that a sequence of perfectives triggers a temporal succession reading (*Narration*) was given up at some point was the failure of this approach on *Elaborations* and *Explanations*, which induce temporal overlap or temporal reversal interpretations regardless of the aspectual properties of the sentences (see Chapter 2, Section 2.2.3). However, since *Elaborations*, as (parts of) *Restatements*, and *Explanations* are taken care of independently in the present approach, one could seriously reconsider the role of aspect in distinguishing between *Narration* and other coordinating relations. Of course, this distinction should not be hard-wired in the conventional semantics of the aspectual categories, otherwise it would conflict with the consequences of *Restatement* and *Explanation* and the old problems would return. But an appropriate pragmatic solution with the same temporal effects should be able to do the job.

Relations that must be signalled explicitly

Finally, let's return to the question why certain discourse relations cannot remain implicit. In Chapter 2, two classes of relations were pointed out whose implicit realisation possibilities are severely limited: non-veridical relations and the "denial of expectation" type of *Contrast* (concession). The former cannot be inferred between asyndetically connected sentences, nor between conjoined sentences in the absence of more explicit relation markers, cf. Section 2.1.4.²⁰ The latter is possible in *and*-conjunctions if world knowledge associated with the meanings of the sentences suggests a concessive relation (if ϕ then normally not ψ), but it is excluded for asyndetically connected sentences regardless of intonation.

Concerning non-veridicals, the informal suggestion in Section 2.4 was that relational meaning can only undergo strengthening. Uttering a pair of asyndetically connected or conjoined sentences, the speaker commits him- or herself to the truth of both sentences, so the discourse relation between them must be at least as strong as their logical conjunction. Since non-veridicals are weaker than the logical conjunction, they cannot be so conveyed.

²⁰Some exceptions are allowed for conditionals.

This would exactly be the prediction of the current theory assuming a simpler approach to exhaustive interpretation that does not take relevance and optimal interpretation into account, such as that presented in Section 6.3.3, Chapter 6. The relevant definition of exhaustive update is repeated in (738).

$$(738) s[\phi]_{exh}^P = s[\phi] \cap \min_{<P}(s_0[\phi])$$

Under this approach, indeed, pragmatic inference only involves strengthening of the conventional meaning, and a sequence of asyndetically connected or conjoined sentences provably entails their dynamic conjunction. The derivation for asyndetic connection is given in (739)–(743), representing equivalent transformations of $s[\phi]_{exh}^P[\psi]_{exh}^R$.

$$(739) s[\phi]_{exh}^P[\psi]_{exh}^R$$

$$(740) [s[\phi] \cap \min_{<P}(s_0[\phi])][\psi]_{exh}^R, \text{ by definition of } s[\phi]_{exh}^P$$

$$(741) [s[\phi] \cap \min_{<P}(s_0[\phi])][\psi] \cap \min_{<R}(s_0[\psi]), \text{ by definition of } s[\phi]_{exh}^P$$

$$(742) s[\phi][\psi] \cap \min_{<P}(s_0[\phi])[\psi] \cap \min_{<R}(s_0[\psi]),$$

by distributivity of update over \cap

$$(743) s[\phi \wedge \psi] \cap \min_{<P}(s_0[\phi])[\psi] \cap \min_{<R}(s_0[\psi]), \text{ by definition of dynamic } \wedge$$

The expression in (743) shows that the information state $s[\phi]_{exh}^P[\psi]_{exh}^R$ can be represented as an intersection of the dynamic conjunction of the normal, non-exhaustive meanings of the sentences $s[\phi \wedge \psi]$ and a proposition corresponding to the pragmatic effects of the $\langle \phi, \psi \rangle$ sequence, subsuming the discourse relation between them— $\min_{<P}(s_0[\phi])[\psi] \cap \min_{<R}(s_0[\psi])$. Thus $s[\phi]_{exh}^P[\psi]_{exh}^R$ entails $s[\phi \wedge \psi]$, that is, the discourse relation between sentences that undergo exhaustive update separately must be veridical. By contraposition, a non-veridical relation cannot result from sentence by sentence update. This means that non-veridical relations must be signalled by sentence connectives, i.e. expressed within a single utterance.²¹ It is easy to show that they can only be signalled by connectives other than conjunction.

In a setting that takes optimal interpretation into account, cf. the definition in (744), the prediction would be much weaker, since optimal interpretation makes it possible to weaken the conventional meaning of a sentence.²²

$$(744) s[\phi]_{exh}^{O,P} = s[\phi]^O \cap \min_{<P}(s_0[\phi]^O)$$

If two utterances undergo exhaustive update separately but are interpreted with respect to the same optimal interpretation function (address the same topic), then the result of such update, $s[\phi]_{exh}^{O,P_1}[\psi]_{exh}^{O,P_2}$, is equivalent to (745). It has been assumed so far that optimal interpretation is only defined for non-logical constants, whereas logical constants such as \wedge always receive standard interpretation. On this assumption, (745) is in turn equivalent to (746), i.e. it entails the dynamic conjunction of ϕ and ψ as interpreted in the sense of O .

²¹Note that in order to arrive at this result it need not be assumed that ϕ and ψ are exhaustivized with respect to the same background predicate, cf. P and R in (739). This means, basically, that a change in information structure does not affect veridicality.

²²Although van Rooij's definition of optimal interpretation can only strengthen the conventional meaning of each particular elementary predicate, see Section 6.4.3, if such a strengthened predicate is negated in the sentence, or occurs in the antecedent of an implication, the overall interpretation of the sentence is weakened.

One could say that the relation is veridical in the sense of O , i.e. the speaker commits him- or herself to the truth of both sentences taken in the currently relevant sense.²³

$$(745) s[\phi]^O[\psi]^O \cap \min_{<O, P_1}(s_0[\phi]^O)[\psi]^O \cap \min_{<O, P_2}(s_0[\psi]^O)$$

$$(746) s[\phi \wedge \psi]^O \cap \min_{<O, P_1}(s_0[\phi]^O)[\psi]^O \cap \min_{<O, P_2}(s_0[\psi]^O)$$

Assuming that a felicitous change of optimal interpretation (i.e. topic change) can only be licensed by explicit topic management devices, the consequence of this is that relations that are not veridical in this weak sense cannot be inferred in the absence of either sentence connectives or signals of topic change. This, in principle, does not exclude a non-veridical relation between two separate utterances,²⁴ but this would only be possible in connection with a change of topic, and it remains to be clarified to what extent the change of topic can give rise to effects resembling *Consequence* or *Alternation* relations. In any case, though, such a change would have to be signalled explicitly.

The above discussion gives an illustration of how the properties of non-veridical relations, in particular their explicit character, can be derived from the general principles of pragmatic interpretation, rather than stipulating those properties in the inference rules for individual relations. In other words, the informal explanation that relates this phenomenon to the strengthening of inter-sentential relations can be modelled formally in a general way within the proposed framework.

Of course the question why certain relations cannot remain implicit will only be fully answered when a similar derivation can also be provided for the “denial of expectation” type of *Contrast*. The theory as it stands is not sufficiently spelled out for that, but speaking informally, the explanation would have two parts. First, denial of expectation cannot be inferred in $s[\phi]_{exh}^{O,P}[\psi]_{exh}^{O,P}$, i.e. between asyndetically connected utterances ending in a completion intonation, like (747), because only *Restatement* and certain relations encoded in the lexicon (e.g. causal *Explanation*) can be inferred in this case. This would presuppose that unlike causes, unexpected circumstances are not encoded in the lexicon.

(747) John can't read (\searrow) . He is a linguist (\searrow) .

Second, explaining the non-occurrence of denial of expectation in open lists such as (748) would depend on the explanation to (a) why relations that cannot spread cannot be inferred between non-final elements of a list; and (b) why denial of expectation cannot spread.²⁵ Developing and formalising the relevant ideas presented in Chapter 3 remains a task for the future.

(748) John can't read (\nearrow) , he is a linguist (\nearrow) ...

In sum, this section has not given but a glimpse of the consequences of the proposed theory as applied to relations other than *Restatement* and *Explanation*. Nevertheless, it provided some preliminary and partial answers to the

²³But of course depending on the nature of O , $s[\phi \wedge \psi]^O$ may be weaker than $s[\phi \wedge \psi]$.

²⁴Something like: *Suppose A* (\searrow). *Then B* (\searrow), which gives rise to a conditional relationship between *A* and *B*.

²⁵See Chapter 2, pp. 54–55, on the notion of backward spreading of discourse relations, as well as Chapter 3, p. 95, on the relationship between spreading, lists, and non-spreading relations.

questions related to the role of such “weak” markers as continuation intonation and conjunction *and* in the inference of implicit discourse relations, as well as the need for “strong” markers in the inference of some other relations. These questions would have to be addressed by a full explanatory theory of discourse interpretation, although they have often been neglected in previous research.

7.5 Conclusions and outlook

This study raised a lot of questions: how and why implicit discourse relations are inferred; what is the role of prosody and conjunction in this process; why such discourse relations as *Restatement* and *Explanation* need not be signalled either by prosody, by conjunction, or by any other linguistic means. Only a very small part of these questions received a formally substantiated answer—effectively, only the case of *Restatement* was studied in detail. In this chapter I set out to propose tentative, informal answers to the remaining questions, not so much to catch up with the plan—the questions raised are fundamental and cannot be handled exhaustively within one dissertation—rather, the intention was to present a theoretical programme in which the proposed analysis of *Restatement* is supposed to constitute a step. In other words, I wanted to point to “big ideas” to whose realisation the present study is intended to make a small contribution.

In sum, the main idea is the Gricean idea. That is, the inferences that come on top of the conventional meanings of sentences are based on the assumption that communication has a goal and that communication participants behave rationally and cooperatively in achieving that goal. The mechanism of exhaustive interpretation as adopted from van Rooij and Schulz (2004b) which played a central role in the proposed analysis of *Restatement* is essentially a (partial) formal implementation of the Gricean Maxims. The second idea concerns analysing discourse goals (topics) as questions under discussion, and modelling relationships between goals associated with individual sentences in connected discourse as relationships between questions those sentences answer (Klein and von Stutterheim, 1987; van Kuppevelt, 1995a). Combining these ideas for the purposes of discourse interpretation was proposed by Zeevat (1994a, 2005), and the current study should be seen as a development of this proposal.

In this type of framework, and specifically in light of the proposals made in this study, the questions we started with receive the following answers:

- How are implicit discourse relations are inferred?

Establishing implicit discourse relations between utterances is a product of (a) establishing relations between topics addressed by the utterances and (b) interpreting the utterances exhaustively with respect to their topics. The lexicon, and in particular, the lexically encoded mereological and causal relations influence discourse interpretation in providing a bound on exhaustification. Unless signalled explicitly by intonation, particles, conjunctions, or other devices, the relations between topics are assumed to obey inertia, i.e. the Principle of Topic Continuity: by default, the topic of the current utterance is the same as the topic of the previous one.

- Why are implicit discourse relations inferred:

Expanding on Zeevat (2005): The question why there are discourse relations is reduced to the questions (a) why utterances have topics; and

(b) why interpretation is exhaustive. Towards answering (a): topics arise as a reflex of speakers' intentions and their ability of rational discourse planning based on the same principles as rational planning of action in general. Towards answering (b): exhaustive interpretation is a product of rational and cooperative communicative behaviour in accordance with the Gricean principle.

Previous formal approaches to the inference of implicit discourse relations culminating in the work of Asher and Lascarides (2003) have predominantly taken the position that this inference is driven by the goal of establishing discourse coherence. Since discourse relations (or otherwise, *coherence* relations) are seen as the basic units of coherence in this framework, they also have to be explicitly represented, but as such, they constitute the ontological primitives of the theory and remain unanalysed. One corollary of this approach often criticised by its opponents, e.g. Blakemore (1997), is a commitment to a particular inventory of discourse relations which is always hard to motivate conclusively. However, previous attempts to derive discourse relations from more general mechanisms such as the intentionality of discourse, or the Gricean communication principles (in particular, *relevance*) remained for the most part unformalised. Thus Asher and Lascarides' SDRT found no competitors in the area of formal approaches to discourse semantics and pragmatics and, in particular, the phenomenon of discourse relations.

In this study, I took up the challenge of addressing some of the critical points put forward by Asher and Lascarides (2003) against previous attempts to derive a theory of discourse relations from Gricean pragmatics. The first point that concerns the lacking formalisation of Gricean theories is becoming obsolete with the development of optimality theoretic pragmatics as represented, for instance, by the collection of papers in Blutner and Zeevat (2003). The work of van Rooij and Schulz (2004b), on which the proposed formalisation of *Restatement* is based, is one contribution to this enterprise. Secondly, Asher and Lascarides criticised traditional approaches to pragmatics for being "sentential" in that they calculate implicatures of individual utterances but fail to represent meaningful links between utterances. This is a valid point as long as the Gricean approach is taken on its own. However, once combined with a notion of intentional structure (QUD structure, topic structure) along the lines of Zeevat (1994a, 2005), meaningful links between utterances can be reconstructed from links between the underlying intentions, QUDs, or topics. The presented study demonstrated this for the relation of *Restatement* and certain cases of *Elaboration*. It was shown how the relations of mereological part and identity between eventualities can be derived from the assumption of the identity of topics (Topic Continuity). The third point of criticism that specifically concerns the idea of deriving discourse relations from intentions is the difficulty to access the speakers' intentions together with other "private" features of another person's mental state. Nevertheless, hearers appear capable of inferring discourse relations without having perfect information of the speaker's goals. This is a valid point, too, but there are reasons to believe that the proposed approach can get around this problem. As I tried to show for *Restatement* (though only informally), it is not necessary to know what the topic is to infer this relation, it is enough to know that the topic of the utterances is *the same*, which is a consequence of Topic Continuity. Once this observation can be given a formal

proof, and once other relations can be treated in the same way, Asher and Lascarides' point will not only be met—it will be derived as a consequence of the theory. Finally, Asher and Lascarides argued that in certain cases the information of domain-level plans and knowledge is not only unnecessary but also potentially hindering for the correct inference of a discourse relation, and that the access to such information should be appropriately limited. A version of this idea was accommodated in the proposed modification of van Rooij and Schulz' definition of exhaustive interpretation, making the process of model minimisation only sensitive to lexical or highly conventionalised world knowledge, but not the whole load of information in the common ground. Although admittedly the relationship between this and Asher and Lascarides' original idea has not been sufficiently explored, the ideas seem to be closely related.

In sum, in this study I have tried to demonstrate how a Gricean approach to discourse relations can both stand up to Asher and Lascarides' criticism and profit from it without giving up the main principles of Gricean pragmatics. At the same time, by deriving discourse relations as an epiphenomenon of Gricean implicature, this approach can avoid such unelegant commitments as a specific inventory of relations.

Finally, one should mention the special role played by the consideration of prosody in achieving these results. Taking into account the distinction between completion and continuation intonation as well as certain intonational and other linguistic differences between spontaneous and read speech, it became possible to separate a number of distinct usages of asyndetic connection between sentences, which was essential for identifying the special status of *Restatement* (including *Elaboration*) and *Explanation* among other discourse relations. Looking carefully at these intonational distinctions suggested the hypothesis that the usage of the default pattern $U_1 (\searrow) U_2 (\searrow)$ —the combination of asyndetic connection and completion intonation—with relations other than *Restatement* and *Explanation* is restricted, or at least mildly penalised in spontaneous speech. The preference for *Restatement* and *Explanation* readings associated with this pattern was the crucial point that led to the idea of analysing these relations as the primary effect of the default principles of Exhaustive Interpretation and Topic Continuity in the strong sense, i.e. the topic of the current utterance being *exactly* the same as that of the previous one. In this light, discourse relations such as *Narration*, which are traditionally viewed as effects of Topic Continuity, had to be reanalysed as resulting either from a violation of Exhaustivity, or a local violation of Continuity, the topic being maintained at the second structural level. Thus if the proposed hypothesis is correct and discourse relations like *Restatements* and *Explanation* can also be reconstructed as effects of Topic Continuity, then the theory of discourse relations based on topic management can be made quite simple. The role of the general principles in dealing with the topic structure (the QUD stack) would be increased, and the role of domain knowledge would be reduced. Ultimately, the role of domain knowledge could be reduced to filtering out topic combinations that give rise to impossible or unlikely readings, but one could avoid using domain knowledge directly for “suggesting” topics (putting topics on the QUD stack). In sum, the consideration of prosody revealed patterns that could be attributed to the functioning of the general principles Exhaustive Interpretation and Topic Continuity. These patterns had been easily overlooked in previous work due to insufficient attention to intonation.

The above summarises the main results of the presented work. However, there were some minor accomplishments as well which served as an intermediate step on the way to the final goal, but which may also be of interest independently. One such result is perhaps worth special mention. While developing an account of *Restatement* based on the process of exhaustification, I identified and investigated the phenomenon of nominal restatement, which seems to take an intermediate position between restatement in general as a discourse phenomenon and the syntactic phenomenon of nominal apposition. Nominal restatement was shown to share a lot of properties with sentential restatement at the discourse level, which motivated a uniform analysis in terms of exhaustification. At the same time, it is similar to nominal apposition in that it can be linearly embedded in a sentence. A relationship between restatement and apposition had often been noted before, but the linguistic similarities and differences between them had remained underexplored. In this study I made a step towards clarifying this issue.

It need not be repeated that this study has raised more questions than it has answered, and there remains a lot to be done in the future. Many open issues have been pointed out in this chapter; by way of summary, I will mention the most important ones. First of all, although the presented work bears on a number of general issues in theoretical pragmatics, it remains primarily a case study on the discourse relation of *Restatement*. This is the only relation that received a more or less detailed and formal treatment, whereas other relations were only mentioned in passing or discussed informally. It should also be made clear that the current study has only dealt with the mereological and related temporal consequences of *Restatement*—the part-whole and identity relations between the described events—whereas many other phenomena that are known to be sensitive to discourse relations such as various sorts of anaphora, presupposition, ellipsis etc. were left completely outside our focus of attention. Obviously, before we can seriously talk about a Gricean alternative to SDRT, both a comprehensive reconstruction of the SDRT inventory of relations must be provided and the relevant range of phenomena must be captured in a formally precise way.

The second direction for future work is further development of the formal tools. In this study, I have introduced a number of modifications to the mechanism of exhaustive interpretation proposed by van Rooij and Schulz (2004b). Most notably, the role of optimal interpretation functions was increased dramatically in comparison to the original proposal, to the extent that optimal interpretation has completely replaced the conventional interpretation function in the definition of both exhaustive and non-exhaustive discourse update. However, the overall consequences of this change were only given a superficial look and will have to be studied in more detail. It is possible that this technical move will even find further applications, for instance, as an approach to the pragmatic domain restriction of quantificational expressions like *every* and *most*.

Thirdly, the patterns of prosodic realisation of discourse relations that motivated the presented theoretical proposal remain largely a hypothetical matter. Although the results of previous empirical studies suggest that the proposed hypothesis is worth pursuing, they cannot be regarded as conclusive evidence for it. In this study, I have tried to illustrate the intuitions behind it as clearly as possible and make the predictions as concrete as possible to make an empirical assessment more or less straightforward. However, the actual empirical testing

still needs to be done.

Finally, sooner or later we should ask ourselves whether an approach to discourse relations along the lines of the proposed theory is realistic from the cognitive point of view. All that can be said at this point is that this coin has two sides. On the one hand, the present approach is cast in terms of the classical model-theoretic notion of possible worlds, which are known to have no direct correlates in the cognitive representation of meaning (Dowty, 1979, pp. 375–395). On the other hand this study promotes the role of exhaustive interpretation, which is nothing else than the selection of a *minimal* world (or model) from the range of all possibilities satisfying the description in the discourse. But it has been argued that humans do construct minimal models in the process of interpretation. Thus exhaustification can be seen as a way to simulate this process in a possible worlds semantics. The construction of minimal models can also be given a more direct formal implementation, for instance, along the lines of van Lambalgen and Hamm (2005). This has recently led to the realisation that formal and cognitive approaches to semantics can be reconciled (Hamm et al., 2005). Thus the notion of exhaustive interpretation constitutes a possible link between the present work and cognitively motivated theories of discourse. This link should be explored more thoroughly in the long run.

Appendix A

Formalisation I

This appendix spells out some of the formal foundations of the analysis of re-statement given in Chapter 5 and provides proofs of some statements. The general assumption is a higher order λ -calculus with a standard interpretation.

A.1 Mereology

Krifka's (1989) axiomatization of mereology is given below:¹

- (749) a. $\forall e[e \oplus e = e]$ (idempotency)
b. $\forall e \forall e' \exists e''[e \oplus e' = e'']$ (totality of \oplus)
c. $\forall e \forall e'[e \oplus e' = e' \oplus e]$ (commutativity)
d. $\forall e \forall e' \forall e''[e \oplus (e' \oplus e'') = (e \oplus e') \oplus e'']$ (associativity)
e. $\forall e \forall e'[e \oplus e' = e' \leftrightarrow e \leq e']$ (definition of \leq)
f. $\neg \exists e \forall e'[e \leq e']$ (no bottom element)
g. $\forall e \forall e'[e \leq e' \wedge e \neq e' \leftrightarrow e < e']$ (definition of $<$)
h. $\forall e \forall e'[e \circ e' \leftrightarrow \exists e''[e'' \leq e \wedge e'' \leq e']]$ (overlap)
i. $\forall e \forall e' \forall e''[e \circ (e' \oplus e'') \rightarrow e \circ e' \vee e \circ e'']$ (distributivity of \circ)
j. $\forall e \forall e'[e \leq e' \rightarrow \exists e''[\neg e'' \circ e \wedge e'' \oplus e = e' \wedge \forall e * [\neg e * \circ e \wedge e * \oplus e = e' \rightarrow e * = e'']]]$ (unique relative complements)

A.2 Non-Boolean conjunction and EQS

A.2.1 Definitions

(750) Non-Boolean conjunction on unary predicates, $\oplus_{\langle e, t \rangle}$:
$$\oplus_{\langle e, t \rangle} = \lambda P \lambda P' \lambda e \exists e_1 \exists e_2 [P(e_1) \wedge P'(e_2) \wedge e = e_1 \oplus e_2]$$

(751) Non-Boolean conjunction on quantifiers, $\oplus_{\langle \langle e, t \rangle t \rangle}$:
$$\oplus_{\langle \langle e, t \rangle t \rangle} = \lambda T \lambda T' \lambda P [T(\lambda y [T'(\lambda x [P(x \oplus y)])])]$$

(752) Existential quantifier shift, EQS:
$$\text{EQS} = \lambda Q \lambda P \exists e [Q(e) \wedge P(e)]$$

¹There is one change as compared to the version in Krifka (1989). In (749g), \rightarrow is replaced by \leftrightarrow .

A.2.2 Distributivity of EQS over non-Boolean conjunction

Existential quantifier shift (EQS) is distributive over non-Boolean conjunction, that is:

$$(753) \forall R \forall P_1 \forall P_2 [[\text{EQS}(P_1 \oplus_{\langle e,t \rangle} P_2)](R) \leftrightarrow [\text{EQS}(P_1) \oplus_{\langle \langle e,t \rangle t \rangle} \text{EQS}(P_2)](R)]$$

Proof: Let's take arbitrary unary predicates P_1 , P_2 and R and prove that:

$$(754) [\text{EQS}(P_1 \oplus_{\langle e,t \rangle} P_2)](R) \leftrightarrow [\text{EQS}(P_1) \oplus_{\langle \langle e,t \rangle t \rangle} \text{EQS}(P_2)](R)$$

Let's consider some equivalent transformations of the first part of the biconditional:

$$(755) [\text{EQS}(P_1 \oplus_{\langle e,t \rangle} P_2)](R)$$

By the definition of $\oplus_{\langle e,t \rangle}$, (755) is equivalent to (756):

$$(756) [\text{EQS}(\lambda e \exists e_1 \exists e_2 [P_1(e_1) \wedge P_2(e_2) \wedge e = e_1 \oplus e_2])](R)$$

By the definition of EQS, (756) is equivalent to (757):

$$(757) [[\lambda Q_1 \lambda Q_2 \exists e' [Q_1(e') \wedge Q_2(e')]][\lambda e \exists e_1 \exists e_2 [P_1(e_1) \wedge P_2(e_2) \wedge e = e_1 \oplus e_2]]](R)$$

Reducing λ -s, we get:

$$(758) \exists e' \exists e_1 \exists e_2 [P_1(e_1) \wedge P_2(e_2) \wedge e' = e_1 \oplus e_2 \wedge R(e')]$$

Since $\exists e' [e' = e_1 \oplus e_2 \wedge R(e')] \text{ iff } R(e_1 \oplus e_2)$, (758) is equivalent to (759):

$$(759) \exists e_1 \exists e_2 [P_1(e_1) \wedge P_2(e_2) \wedge R(e_1 \oplus e_2)]$$

Thus (755) is equivalent to (759).

Now let's consider equivalent transformations of the second part of the biconditional in (754):

$$(760) [\text{EQS}(P_1) \oplus_{\langle \langle e,t \rangle t \rangle} \text{EQS}(P_2)](R)$$

By the definition of EQS and λ reduction, (760) is equivalent to (761):

$$(761) [[\lambda Q_2 \exists e' [P_1(e') \wedge Q_2(e')]] \oplus_{\langle \langle e,t \rangle t \rangle} [\lambda Q_4 \exists e'' [P_2(e'') \wedge Q_4(e'')]]](R)$$

By the definition of $\oplus_{\langle \langle e,t \rangle t \rangle}$, (761) is equivalent to (762):

$$(762) [\lambda P [[\lambda Q_2 \exists e' [P_1(e') \wedge Q_2(e')]] (\lambda y [[\lambda Q_4 \exists e'' [P_2(e'') \wedge Q_4(e'')]] (\lambda x [P(x \oplus y)]))]]](R)$$

Reducing λ -s, we get:

$$(763) \exists e' \exists e'' [P_1(e') \wedge P_2(e'') \wedge R(e' \oplus e'')]$$

Thus (760) is equivalent to (763). But obviously, (763) is equivalent to (759), whereas (759) is in turn equivalent to (755) as was proved earlier. Hence (755) is equivalent to (760), i.e. for arbitrary unary predicates P_1 , P_2 and R holds:

$$(764) [\text{EQS}(P_1 \oplus_{\langle e,t \rangle} P_2)](R) \leftrightarrow [\text{EQS}(P_1) \oplus_{\langle \langle e,t \rangle t \rangle} \text{EQS}(P_2)](R)$$

Q.E.D.

A.3 Groenendijk and Stokhof's exhaustification

A.3.1 Definitions

- (765) The interpretation of a constituent answer α is $[\text{EXH}(\alpha')](\beta')$ where
- α' is the interpretation of the term α (a generalised quantifier);
 - β' is the relational interpretation of a single constituent interrogative;
 - EXH is the semantic operation of exhaustification.

Groenendijk and Stokhof's definition of the exhaustification operator EXH is given in the set notation (766) and the functional notation (767):

$$(766) \text{EXH}(Q) = \{P \mid P \in Q \wedge \neg \exists P' [P' \in Q \wedge P' \subset P]\}$$

$$(767) \text{EXH} = \lambda Q \lambda P [Q(P) \wedge \neg \exists P' [Q(P') \wedge P \neq P' \wedge \forall x [P'(x) \rightarrow P(x)]]]$$

A.3.2 Exhaustification theorems

The theorems below follow from Groenendijk and Stokhof's definition of the exhaustification operator EXH and demonstrate the application of this operator to four kinds of quantifiers: (a) individuals, e.g. *Mary*, translated as $\lambda P [P(m)]$; (b) existentials, e.g. *a linguist*, translated as $\lambda P \exists x [\text{linguist}(x) \wedge P(x)]$; and (c) universals, e.g. *every linguist*, translated as $\lambda P \forall x [\text{linguist}(x) \rightarrow P(x)]$; (d) Boolean conjunctions of individuals (distributive readings of plurals), e.g. *John and Mary*, translated as $\lambda P [P(j) \wedge P(m)]$.

$$(768) \text{EXH}(\lambda P [P(m)]) = \lambda P \forall x [P(x) \leftrightarrow x = m]$$

$$(769) \text{EXH}(\lambda P \exists x [\text{linguist}(x) \wedge P(x)]) = \lambda P \exists x [\text{linguist}(x) \wedge \forall y [P(y) \leftrightarrow y = x]]$$

$$(770) \text{EXH}(\lambda P \forall x [\text{linguist}(x) \rightarrow P(x)]) = \lambda P \forall x [\text{linguist}(x) \leftrightarrow P(x)]$$

$$(771) \text{EXH}(\lambda P [P(j) \wedge P(m)]) = \lambda P \forall x [P(x) \leftrightarrow [x = j \vee x = m]]$$

See Groenendijk and Stokhof (1990, pp. 34–35).

A.3.3 Restatement: existential + individual

The conjunction of the exhaustive interpretations of *a linguist* and *Mary* with respect to the question *Who P?* (i.e. question predicate P) is equivalent to the statement that Mary is a linguist and the only individual that has property P . That is, the following propositions are equivalent:

$$(772) \exists x [\text{linguist}(x) \wedge \forall y [P(y) \leftrightarrow x = y]] \wedge \forall z [P(z) \leftrightarrow z = m]$$

$$(773) \text{linguist}(m) \wedge \forall y [P(y) \leftrightarrow y = m]$$

Proof: (772) is equivalent to:

$$(774) \exists x [\text{linguist}(x) \wedge \forall y [P(y) \leftrightarrow x = y] \wedge \forall z [P(z) \leftrightarrow z = m]]$$

Let's consider two cases, one in which $x = m$ and one in which $x \neq m$. Suppose first that $x = m$, that is:

$$(775) \exists x [x = m \wedge \text{linguist}(x) \wedge \forall y [P(y) \leftrightarrow y = x] \wedge \forall z [P(z) \leftrightarrow z = m]]$$

This is equivalent to (776), (777), and finally (778):

$$(776) \exists x[x = m \wedge \text{linguist}(x) \wedge \forall y[P(y) \leftrightarrow y = m] \wedge \forall z[P(z) \leftrightarrow z = m]]$$

$$(777) \exists x[x = m \wedge \text{linguist}(x) \wedge \forall y[P(y) \leftrightarrow y = m]]$$

$$(778) \text{linguist}(m) \wedge \forall y[P(y) \leftrightarrow y = m]$$

Now let's consider the other possibility, i.e. $x \neq m$:

$$(779) \exists x[x \neq m \wedge \text{linguist}(x) \wedge \forall y[P(y) \leftrightarrow y = x] \wedge \forall z[P(z) \leftrightarrow z = m]]$$

But if $y = x$ and $x \neq m$, then $y \neq m$. Hence, (779) entails:

$$(780) \forall y[[P(y) \rightarrow y \neq m] \wedge [P(y) \rightarrow y = m]]$$

This is a contradiction. Therefore $x = m$ is the only possibility. Hence (772) is equivalent to $\exists x[x = m \wedge \text{linguist}(x) \wedge \forall y[P(y) \leftrightarrow y = x] \wedge \forall z[P(z) \leftrightarrow z = m]]$ (775), which in turn is equivalent to $\text{linguist}(m) \wedge \forall y[P(y) \leftrightarrow y = m]$, i.e. (773). Q.E.D.

A.3.4 Restatement: existential + existential

The conjunction of the exhaustive interpretations of *a child* and *a girl* with respect to the question predicate P is equivalent to the statement that there is an individual who is both a child and a girl and that is the only individual that has property P . That is, the following propositions are equivalent:

$$(781) \exists x[\text{child}(x) \wedge \forall x'[P(x') \leftrightarrow x = x']] \wedge \exists y[\text{girl}(y) \wedge \forall y'[P(y') \leftrightarrow y = y']]$$

$$(782) \exists x[\text{child}(x) \wedge \text{girl}(x) \wedge \forall x'[P(x') \leftrightarrow x = x']]$$

Proof: Since y does not occur in the first conjunct of (781), the second existential quantifier can be fronted, thus (781) is equivalent to (783):

$$(783) \exists x \exists y[\text{child}(x) \wedge \text{girl}(y) \wedge \forall x'[P(x') \leftrightarrow x = x'] \wedge \forall y'[P(y') \leftrightarrow y = y']]$$

Let's consider two cases: $x = y$ and $x \neq y$. Suppose $x = y$, that is:

$$(784) \exists x \exists y[x = y \wedge \text{child}(x) \wedge \text{girl}(y) \wedge \forall x'[P(x') \leftrightarrow x = x'] \wedge \forall y'[P(y') \leftrightarrow y = y']]$$

This is equivalent to (785), (786), and finally (787):

$$(785) \exists x \exists y[x = y \wedge \text{child}(x) \wedge \text{girl}(y) \wedge \forall x'[P(x') \leftrightarrow x = x'] \wedge \forall y'[P(y') \leftrightarrow x = y']]$$

$$(786) \exists x \exists y[x = y \wedge \text{child}(x) \wedge \text{girl}(y) \wedge \forall x'[P(x') \leftrightarrow x = x']]$$

$$(787) \exists x[\text{child}(x) \wedge \text{girl}(x) \wedge \forall x'[P(x') \leftrightarrow x = x']]$$

Now let's consider the case where $x \neq y$:

$$(788) \exists x \exists y[x \neq y \wedge \text{child}(x) \wedge \text{girl}(y) \wedge \forall x'[P(x') \leftrightarrow x = x'] \wedge \forall y'[P(y') \leftrightarrow y = y']]$$

If $x \neq y$ and $y = y'$, then $x \neq y'$. Hence (788) entails:

$$(789) \exists x[\forall x'[P(x') \leftrightarrow x = x'] \wedge [P(x') \leftrightarrow x \neq x']]$$

This is a contradiction. Therefore $x = y$ is the only possibility. Hence (781) is equivalent to (785), which in turn is equivalent to $\exists x[\text{child}(x) \wedge \text{girl}(x) \wedge \forall x'[P(x') \leftrightarrow x = x']]$, i.e. (782). Q.E.D.

A.4 Groenendijk and Stokhof's exhaustification, modified version

A.4.1 Definitions

First, an auxiliary operator is defined that takes all singleton sets from the input quantifier Q and puts them into one set (Q^+ in Bonomi and Casalegno's original notation). The definition is formulated in set notation and in functional notation:

$$(790) B\&C(Q) = \lambda x \exists P [Q(P) \wedge P = \{x\}]$$

$$(791) B\&C(Q) = \lambda x \exists P [Q(P) \wedge \forall y [P(y) \leftrightarrow y = x]]$$

The exhaustification operator $\text{EX}_{B\&C}$ (O in Bonomi and Casalegno's original notation) is then defined as follows:

$$(792) \text{EX}_{B\&C}(Q) = \lambda P \exists x [[B\&C(Q)](x) \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

Substituting the definition for $B\&C$ in (792) gives:

$$(793) \text{EX}_{B\&C}(Q) = \lambda P \exists x [\exists R [Q(R) \wedge \forall y [R(y) \leftrightarrow y = x]] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

A.4.2 Exhaustification theorems

The theorems below follow from the modified definition of the exhaustification operator $\text{EX}_{B\&C}$, showing its application to three kinds of quantifiers: (a) complex individuals, e.g. *John and Mary*, translated as $\lambda P [P(j \oplus m)]$; (b) a non-Boolean conjunction of an existential and an individual, e.g. *a linguist and Mary*, translated as $\lambda P \exists x [\text{linguist}(x) \wedge P(x \oplus m)]$; (c) complex (plural) existentials, e.g. *two linguists*, translated as $\lambda P \exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge P(x \oplus y)]$. The proofs of these theorems are given in Sections A.4.3, A.4.4, and A.4.5.

$$(794) \text{EX}_{B\&C}(\lambda P [P(j \oplus m)]) = \lambda P [P(j \oplus m) \wedge \forall x [P(x) \rightarrow x \leq j \oplus m]]$$

$$(795) \text{EX}_{B\&C}(\lambda P \exists x [\text{linguist}(x) \wedge P(x \oplus m)]) = \lambda P \exists x [\text{linguist}(x) \wedge P(x \oplus m) \wedge \forall y [P(y) \rightarrow y \leq x \oplus m]]$$

$$(796) \text{EX}_{B\&C}(\lambda P \exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge P(x \oplus y)]) = \lambda P \exists x \exists y [x \neq y \wedge \text{linguist}(x) \wedge \text{linguist}(y) \wedge P(x \oplus y) \wedge \forall z [P(z) \rightarrow z \leq x \oplus y]]$$

All three cases exemplify collective readings of plural NPs. Applying $\text{EX}_{B\&C}$ to distributive plurals, e.g. the distributive reading of *John and Mary*, translated as $\lambda P [P(j) \wedge P(m)]$, or distributive quantifiers like *every linguist*, translated as $\lambda P \forall x [\text{linguist}(x) \rightarrow P(x)]$ leads to incorrect predictions. See Sections A.4.6 and A.4.6.

A.4.3 Exhaustification of *John and Mary*

Applying the exhaustification operator $\text{EX}_{B\&C}$ to the collective reading of *John and Mary*, translated as $\lambda P [P(j \oplus m)]$, returns a set of sets containing $j \oplus m$ and its \leq -parts:

$$(797) \text{EX}_{B\&C}(\lambda P [P(j \oplus m)]) = \lambda P [P(j \oplus m) \wedge \forall x [P(x) \rightarrow x \leq j \oplus m]]$$

Proof: Let's show that (798) is equivalent to $\lambda S[S(j \oplus m) \wedge \forall x[S(x) \rightarrow x \leq j \oplus m]]$.

$$(798) \text{EXH}_{B\&C}(\lambda S[S(j \oplus m)])$$

By the definition of $\text{EXH}_{B\&C}$, (798) is equivalent to:

$$(799) [\lambda Q \lambda P \exists x [\exists R [Q(R) \wedge \forall y [R(y) \leftrightarrow y = x]] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]] (\lambda S[S(j \oplus m)])$$

By reducing the λ -s and extending the scope of $\exists R$, we get:

$$(800) \lambda P \exists x \exists R [R(j \oplus m) \wedge \forall y [R(y) \leftrightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

Let's show that the only x that satisfies (800) is $j \oplus m$. Since $\forall y [R(y) \leftrightarrow y = x]$ iff $R(x) \wedge \forall y [R(y) \rightarrow y = x]$, (800) is equivalent to:

$$(801) \lambda P \exists x \exists R [R(j \oplus m) \wedge R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

But $R(j \oplus m) \wedge \forall y [R(y) \rightarrow y = x]$ entails that $j \oplus m = x$. Hence we can add $x = j \oplus m$ to the conjunction:

$$(802) \lambda P \exists x \exists R [x = j \oplus m \wedge R(j \oplus m) \wedge R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

The existential quantifier over x can be eliminated, so (802) is equivalent to:

$$(803) \lambda P \exists R [R(j \oplus m) \wedge \forall y [R(y) \rightarrow y = j \oplus m] \wedge P(j \oplus m) \wedge \forall x' [P(x') \rightarrow x' \leq j \oplus m]]$$

Narrowing the scope of $\exists R$:

$$(804) \lambda P [\exists R [R(j \oplus m) \wedge \forall y [R(y) \rightarrow y = j \oplus m]] \wedge P(j \oplus m) \wedge \forall x' [P(x') \rightarrow x' \leq j \oplus m]]$$

But the first conjunct $\exists R [R(j \oplus m) \wedge \forall y [R(y) \rightarrow y = j \oplus m]]$ is always true: R is instantiated by $\{j \oplus m\}$. Hence (804) is equivalent to:

$$(805) \lambda P [P(j \oplus m) \wedge \forall x' [P(x') \rightarrow x' \leq j \oplus m]]$$

Thus (798) is equivalent to (805). Q.E.D.

A.4.4 Exhaustification of a *linguist and Mary*

Applying the exhaustification operator $\text{EXH}_{B\&C}$ to the collective reading of a *linguist and Mary*, translated as $\lambda P \exists x [\text{linguist}(x) \wedge P(x \oplus m)]$, returns a set of sets containing a \oplus -group of Mary and an individual that is a linguist, and \leq -parts of that group:

$$(806) \text{EXH}_{B\&C}(\lambda P \exists x [\text{linguist}(x) \wedge P(x \oplus m)]) = \lambda P \exists x [\text{linguist}(x) \wedge P(x \oplus m) \wedge \forall y [P(y) \rightarrow y \leq x \oplus m]]$$

Proof: Let's show that (807) is equivalent to $\lambda P \exists x [\text{linguist}(x) \wedge P(x \oplus m) \wedge \forall y [P(y) \rightarrow y \leq x \oplus m]]$

$$(807) \text{EXH}_{B\&C}(\lambda S \exists z [\text{linguist}(z) \wedge S(z \oplus m)])$$

By the definition of $\text{EXH}_{B\&C}$, (807) is equivalent to:

$$(808) [\lambda Q \lambda P \exists x [\exists R [Q(R) \wedge \forall y [R(y) \leftrightarrow y = x]] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]] \\ (\lambda S \exists z [linguist(z) \wedge S(z \oplus m)])$$

By reducing the λ -s and extending the scope of $\exists R$ and $\exists z$, we get:

$$(809) \lambda P \exists x \exists z \exists R [linguist(z) \wedge R(z \oplus m) \wedge \forall y [R(y) \leftrightarrow y = x] \wedge \\ P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

Let's show that the only x that satisfies (809) is $z \oplus m$. Since $\forall y [R(y) \leftrightarrow y = x]$ iff $R(x) \wedge \forall y [R(y) \rightarrow y = x]$, (809) is equivalent to:

$$(810) \lambda P \exists x \exists z \exists R [linguist(z) \wedge R(z \oplus m) \wedge R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge \\ P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

But $R(z \oplus m) \wedge \forall y [R(y) \rightarrow y = x]$ entails that $z \oplus m = x$. Hence we can add $x = z \oplus m$ to the conjunction:

$$(811) \lambda P \exists x \exists z \exists R [x = z \oplus m \wedge linguist(z) \wedge R(z \oplus m) \wedge R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge \\ P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

The existential quantifier $\exists x$ can be eliminated since $\exists x [x = z \oplus m \wedge R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$ is equivalent to $R(z \oplus m) \wedge \forall y [R(y) \rightarrow y = z \oplus m] \wedge P(z \oplus m) \wedge \forall x' [P(x') \rightarrow x' \leq z \oplus m]$. Thus (811) is equivalent to:

$$(812) \lambda P \exists z \exists R [linguist(z) \wedge R(z \oplus m) \wedge \forall y [R(y) \rightarrow y = z \oplus m] \wedge \\ P(z \oplus m) \wedge \forall x' [P(x') \rightarrow x' \leq z \oplus m]]$$

Narrowing the scope of $\exists R$:

$$(813) \lambda P \exists z [\exists R [R(z \oplus m) \wedge \forall y [R(y) \rightarrow y = z \oplus m]] \wedge \\ linguist(z) \wedge P(z \oplus m) \wedge \forall x' [P(x') \rightarrow x' \leq z \oplus m]]$$

But $\exists R [R(z \oplus m) \wedge \forall y [R(y) \rightarrow y = z \oplus m]]$ holds as long as z and m exist; then R is instantiated by $\{z \oplus m\}$. Hence it can be eliminated, so (813) is equivalent to:

$$(814) \lambda P \exists z [linguist(z) \wedge P(z \oplus m) \wedge \forall x' [P(x') \rightarrow x' \leq z \oplus m]]$$

Thus (807) is equivalent to (814). Q.E.D.

A.4.5 Exhaustification of *two linguists*

Applying the exhaustification operator $\text{EXH}_{B\&C}$ to the quantifier *two linguists*, translated as $\lambda P \exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge P(x \oplus y)]$ returns a set of sets containing \oplus -groups of two linguists, and \leq -parts of those groups:

$$(815) \text{EXH}_{B\&C} (\lambda P \exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge P(x \oplus y)]) = \\ \lambda P \exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge P(x \oplus y) \wedge \forall z [P(z) \rightarrow z \leq x \oplus y]]$$

Proof: Let's show that (816) is equivalent to $\lambda P \exists z_1 \exists z_2 [z_1 \neq z_2 \wedge linguist(z_1) \wedge linguist(z_2) \wedge P(z_1 \oplus z_2) \wedge \forall x' [P(x') \rightarrow x' \leq z_1 \oplus z_2]]$.

$$(816) \text{EXH}_{B\&C} (\lambda S \exists z_1 \exists z_2 [z_1 \neq z_2 \wedge linguist(z_1) \wedge linguist(z_2) \wedge S(z_1 \oplus z_2)])$$

By the definition of $\text{EXH}_{B\&C}$, (816) is equivalent to:

$$(817) [\lambda Q \lambda P \exists x [\exists R [Q(R) \wedge \forall y [R(y) \leftrightarrow y = x]] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]] \\ (\lambda S \exists z_1 \exists z_2 [z_1 \neq z_2 \wedge \text{linguist}(z_1) \wedge \text{linguist}(z_2) \wedge S(z_1 \oplus z_2)])$$

By reducing λ -s, we get:

$$(818) \lambda P \exists x \exists R \exists z_1 \exists z_2 [z_1 \neq z_2 \wedge \text{linguist}(z_1) \wedge \text{linguist}(z_2) \wedge R(z_1 \oplus z_2) \wedge \\ \forall y [R(y) \leftrightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

Let's show that the only x that satisfies (818) is $z_1 \oplus z_2$. Since $\forall y [R(y) \leftrightarrow y = x]$ iff $R(x) \wedge \forall y [R(y) \rightarrow y = x]$, (818) is equivalent to:

$$(819) \lambda P \exists x \exists R \exists z_1 \exists z_2 [z_1 \neq z_2 \wedge \text{linguist}(z_1) \wedge \text{linguist}(z_2) \wedge R(z_1 \oplus z_2) \wedge \\ R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

But $R(z_1 \oplus z_2) \wedge \forall y [R(y) \rightarrow y = x]$ entails that $z_1 \oplus z_2 = x$. Hence we can add $x = z_1 \oplus z_2$ to the conjunction:

$$(820) \lambda P \exists x \exists R \exists z_1 \exists z_2 [x = z_1 \oplus z_2 \wedge z_1 \neq z_2 \wedge \text{linguist}(z_1) \wedge \text{linguist}(z_2) \wedge \\ R(z_1 \oplus z_2) \wedge R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$$

The existential quantifier over x can be eliminated since $\exists x [x = z_1 \oplus z_2 \wedge R(x) \wedge \forall y [R(y) \rightarrow y = x] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]$ is equivalent to $R(z_1 \oplus z_2) \wedge \forall y [R(y) \rightarrow y = z_1 \oplus z_2] \wedge P(z_1 \oplus z_2) \wedge \forall x' [P(x') \rightarrow x' \leq z_1 \oplus z_2]$. Thus (820) is equivalent to:

$$(821) \lambda P \exists R \exists z_1 \exists z_2 [z_1 \neq z_2 \wedge \text{linguist}(z_1) \wedge \text{linguist}(z_2) \wedge R(z_1 \oplus z_2) \wedge \forall y [R(y) \rightarrow \\ y = z_1 \oplus z_2] \wedge P(z_1 \oplus z_2) \wedge \forall x' [P(x') \rightarrow x' \leq z_1 \oplus z_2]]$$

Narrowing the scope of $\exists R$:

$$(822) \lambda P \exists z_1 \exists z_2 [\exists R [R(z_1 \oplus z_2) \wedge \forall y [R(y) \rightarrow y = z_1 \oplus z_2]] \wedge \\ z_1 \neq z_2 \wedge \text{linguist}(z_1) \wedge \text{linguist}(z_2) \wedge P(z_1 \oplus z_2) \wedge \forall x' [P(x') \rightarrow x' \leq z_1 \oplus z_2]]$$

The conjunct $\exists R [R(z_1 \oplus z_2) \wedge \forall y [R(y) \rightarrow y = z_1 \oplus z_2]]$ is true whenever there exist individuals z_1 and z_2 , which is the case (then R is instantiated by $\{z_1 \oplus z_2\}$); therefore this conjunct can be eliminated from (822). Hence (822) is equivalent to:

$$(823) \lambda P \exists z_1 \exists z_2 [z_1 \neq z_2 \wedge \text{linguist}(z_1) \wedge \text{linguist}(z_2) \wedge \\ P(z_1 \oplus z_2) \wedge \forall x' [P(x') \rightarrow x' \leq z_1 \oplus z_2]]$$

Therefore (816) is equivalent to (823). Q.E.D.

A.4.6 Exhaustification of distributive quantifiers

The definition of $\text{EXH}_{B\&C}$ leads to absurd predictions when applied to distributive quantifiers, for instance, the distributive reading of *John and Mary*, translated as $\lambda P [P(j) \wedge P(m)]$, or the distributive quantifier *every linguist*, translated as $\lambda P \forall x [\text{linguist}(x) \rightarrow P(x)]$. These problems are demonstrated below.

Suppose the NP *John and Mary* is taken in its distributive reading, i.e. $\lambda P [P(j) \wedge P(m)]$, and is exhaustivized with respect to the question predicate K . Let's show that (824) has absurd entailments.

$$(824) [\text{EXH}_{B\&C} (\lambda S [S(j) \wedge S(m)])](K)$$

By the definition of $\text{EXH}_{B\&C}$, (824) is equivalent to:

$$(825) \quad [[\lambda Q \lambda P \exists x [\exists R [Q(R) \wedge \forall y [R(y) \leftrightarrow y = x]] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]] (\lambda S [S(j) \wedge S(m)])] (K)$$

Reducing the λ -s, we get

$$(826) \quad \exists x \exists R [R(j) \wedge R(m) \wedge \forall y [R(y) \leftrightarrow y = x] \wedge K(x) \wedge \forall x' [K(x') \rightarrow x' \leq x]]$$

But it follows from $R(j) \wedge R(m) \wedge \forall y [R(y) \leftrightarrow y = x]$ that both $x = m$ and $x = j$. Hence $j = m$, i.e. we infer that John and Mary are the same person. This entailment is neither carried by the normal nor by the exhaustive interpretation of *John and Mary*.

Now suppose the NP *every linguist*, translated as $\lambda S \forall z [linguist(z) \rightarrow S(z)]$, is exhaustivized with respect to the question predicate K :

$$(827) \quad [EXH_{B\&C} (\lambda S \forall z [linguist(z) \rightarrow S(z)])] (K)$$

By the definition of $EXH_{B\&C}$, (827) is equivalent to:

$$(828) \quad [[\lambda Q \lambda P \exists x [\exists R [Q(R) \wedge \forall y [R(y) \leftrightarrow y = x]] \wedge P(x) \wedge \forall x' [P(x') \rightarrow x' \leq x]]] (\lambda S \forall z [linguist(z) \rightarrow S(z)])] (K)$$

Reducing the λ -s, we get

$$(829) \quad \exists x \exists R [\forall z [linguist(z) \rightarrow R(z)] \wedge \forall y [R(y) \leftrightarrow y = x] \wedge K(x) \wedge \forall x' [K(x') \rightarrow x' \leq x]]$$

But $\forall z [linguist(z) \rightarrow R(z)] \wedge \forall y [R(y) \leftrightarrow y = x]$ entails $\forall z [linguist(z) \rightarrow z = x]$, in other words, (829) entails that there is an individual x such that every linguist is identical with it. But this entails the existence of exactly one linguist. This entailment is neither carried by the normal nor the exhaustive interpretation of *every linguist*.

A.4.7 Restatement: plural existential + plural individual

The conjunction of the exhaustive interpretations of *two linguists*, translated as $\lambda P \exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge P(x \oplus y)]$, and *John and Mary*, translated as $\lambda P [P(j \oplus m)]$, with respect to the question *Who P?* (i.e. question predicate P) is equivalent to the statement that the group constituted by John and Mary is a group of two linguists, and only these individuals and possibly parts thereof have property P . That is, the following propositions are equivalent:

$$(830) \quad \exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge P(x \oplus y) \wedge \forall z [P(z) \rightarrow [z \leq x \oplus y]]] \wedge [P(j \oplus m) \wedge \forall z' [P(z') \rightarrow [z' \leq j \oplus m]]]$$

$$(831) \quad \exists x \exists y [x \oplus y = j \oplus m \wedge x \neq y \wedge linguist(x) \wedge linguist(y) \wedge P(x \oplus y) \wedge \forall z [P(z) \rightarrow [z \leq x \oplus y]]]$$

Proof: (830) is equivalent to (832) (the existential quantifiers take wide scope).

$$(832) \quad \exists x \exists y [x \neq y \wedge linguist(x) \wedge linguist(y) \wedge P(x \oplus y) \wedge P(j \oplus m) \wedge \forall z [P(z) \rightarrow [z \leq x \oplus y]] \wedge \forall z' [P(z') \rightarrow [z' \leq j \oplus m]]]$$

Let's show that (832) entails $x \oplus y = j \oplus m$. From $P(j \oplus m) \wedge \forall z [P(z) \rightarrow [z \leq x \oplus y]]$, it follows that $j \oplus m \leq x \oplus y$. From $P(x \oplus y) \wedge \forall z' [P(z') \rightarrow [z' \leq j \oplus m]]$, it follows that $x \oplus y \leq j \oplus m$. Thus $x \oplus y$ and $j \oplus m$ are mereological parts of each other, therefore by mereology axioms, $x \oplus y = j \oplus m$.

Since $x \oplus y = j \oplus m$ follows from (832), it can be added to the conjunction, so (832) is equivalent to:

$$(833) \exists x \exists y [x \oplus y = j \oplus m \wedge x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge P(x \oplus y) \wedge P(j \oplus m) \wedge \forall z [P(z) \rightarrow [z \leq x \oplus y]] \wedge \forall z' [P(z') \rightarrow [z' \leq j \oplus m]]]$$

Since $x \oplus y = j \oplus m$, let's substitute $x \oplus y$ for $j \oplus m$ where possible. Thus (833) is equivalent to (834).

$$(834) \exists x \exists y [x \oplus y = j \oplus m \wedge x \neq y \wedge \textit{linguist}(x) \wedge \textit{linguist}(y) \wedge P(x \oplus y) \wedge \forall z [P(z) \rightarrow [z \leq x \oplus y]]]$$

Therefore (830) is equivalent to (834). Q.E.D.

Appendix B

Formalisation II

This appendix provides a formalisation of van Rooij and Schulz' (2004b) notion of dynamic exhaustification based on Dekker's (1993) Modal Dynamic Predicate Logic (MDPL). Unlike the system introduced in Chapter 6, this formal implementation does not only keep track of information about the world, but also about the values of variables—the referents introduced into the discourse universe. (The information state is a set of world-assignment pairs, rather than simply worlds.) The conclusions from the example derivations given in Chapter 6 remain valid for analogous derivations within the present approach. Only the simple, relevance-insensitive notion of exhaustification is implemented.

B.1 MDPL with a structured domain

This section contains a definition of MDPL (Dekker, 1993) extended with a structured domain of individuals, a lattice structure standardly used for the analysis of plurals (Link, 1983; Kamp and Reyle, 1993). I also redefine information states as sets of world-assignment pairs (rather than assignments with a special world variable, as in Dekker's original definition).

B.1.1 Domain structure

Cited after Kamp and Reyle (1993, p. 401):

- (835) An *upper semilattice* is a structure $\mathcal{A} = \langle A, \leq \rangle$, where A is a set of entities and \leq is a partial order on A , i.e. for all $a, b, c \in A$:
- a. $a \leq a$ (reflexivity)
 - b. $[a \leq b \wedge b \leq c] \rightarrow a \leq c$ (transitivity)
 - c. $[a \leq b \wedge b \leq a] \rightarrow a = b$ (antisymmetry)
- with the following additional property that for all $a, b \in A$:
- d. $\exists c \in A [a \leq c \wedge b \leq c \wedge \forall d \in A [[a \leq d \wedge b \leq d] \rightarrow c \leq d]]$
(least upper bound)

The following fact is proved based on (835c) and (835d), cf. Kamp and Reyle (1993, p. 402).

(836) Fact (uniqueness of the join):

If $\mathcal{A} = \langle A, \leq \rangle$ is an upper semilattice, then for all $a, b \in A$
 $\exists! c \in A [a \leq c \wedge b \leq c \wedge \forall d \in A [[a \leq d \wedge b \leq d] \rightarrow c \leq d]]$

(837) Definition of binary supremum \oplus :

Suppose $\mathcal{A} = \langle A, \leq \rangle$ is an upper semilattice.

If $a, b \in A$, then $a \oplus b = c$, $c \in A$, such that

- a. $a \leq c$
- b. $b \leq c$
- c. $\forall d [[a \leq d \wedge b \leq d] \rightarrow c \leq d]$

Operation \oplus is a function $A \times A \mapsto A$. Functionhood and totality follows from (836).

(838) Definition of set supremum $\oplus B$:

Suppose $\mathcal{A} = \langle A, \leq \rangle$ is an upper semilattice.

If $B \subseteq A$, then $b \in A$ is a *supremum* of B , $\oplus B = b$ iff:

- a. $\forall x \in B [x \leq b]$
- b. $\forall d \in A [[\forall x \in B [x \leq d]] \rightarrow b \leq d]$

The set supremum $\oplus B$ is a (possibly partial) function $\mathcal{P}(A) \mapsto A$. $\oplus B$ exists for finite B , for infinite B this need not be so. If $\oplus B$ exists, the uniqueness of $\oplus B$ (functionhood) follows from (835c) and (835d).

(839) Definition of a complete atomic free upper semilattice (Kamp and Reyle, 1993, p. 404):

- a. An upper semilattice $\mathcal{A} = \langle A, \leq \rangle$ is *complete*, if for all $X \subseteq A$ the supremum $\oplus X$ exists.
- b. The *one of* \mathcal{A} , $1_{\mathcal{A}}$, is the largest element of \mathcal{A} .
The *zero of* \mathcal{A} , $0_{\mathcal{A}}$, is the smallest element of \mathcal{A} .
- c. Element a of A is an *atom of* \mathcal{A} , $At(a)$, iff $a \neq 0_{\mathcal{A}}$ and $\forall x [x \leq a \rightarrow [x = a \vee x = 0_{\mathcal{A}}]]$.
- d. \mathcal{A} is *atomic* iff for every $a, b \in A$ such that $a \not\leq b$ there is an atom c such that $c \leq a$ and $c \not\leq b$.
- e. \mathcal{A} is *free* iff for all $a \in A$ and $X \subseteq A$ if $At(a)$ and $a \leq \oplus X$, then $\exists b \in X [a \leq b]$.

There is a number of useful facts about *upper semilattices with a zero* that are *complete, atomic, and free*.

(840) Fact (Kamp and Reyle, 1993, p. 402):

If \mathcal{A} is atomic and complete, then each non-zero element of A can be represented as a sum of atoms:

$$\forall a \in A [a \neq 0_{\mathcal{A}} \rightarrow a = \oplus \{b \in A \mid At(b) \wedge b \leq a\}]$$

(841) Properties of binary \oplus :

- a. $\forall a [a \oplus a = a]$ (idempotency)
- b. $\forall a \forall b \exists c [a \oplus b = c]$ (totality of \oplus)
- c. $\forall a \forall b [a \oplus b = b \oplus a]$ (commutativity)
- d. $\forall a \forall b \forall c [a \oplus (b \oplus c) = (a \oplus b) \oplus c]$ (associativity)

Proof: Idempotency (841a) follows from reflexivity of \leq (835a) and the definition of \oplus (837): $a \leq a$ and $\forall d [[a \leq d \wedge a \leq d] \rightarrow a \leq d]$. Totality (841b)

follows from least upper bound (835d). Commutativity (841c) follows from the definition of \oplus . Associativity follows from the definition of \oplus (837), transitivity (835b) and antisymmetry (835c).

(842) Fact:

$$\forall a \forall b [a \oplus b = b \leftrightarrow a \leq b]$$

Proof: Let's take arbitrary a and b . Then $a \leq b \rightarrow a \oplus b = b$ follows from reflexivity of \leq (835a) and the definition of \oplus (837): $a \leq b$ and $b \leq b$ and $\forall d [a \leq d \wedge b \leq d \rightarrow b \leq d]$. Hence by (837), $b = a \oplus b$. Let's prove that $a \not\leq b \rightarrow a \oplus b \neq b$. By atomicity (839d), if $a \not\leq b$ then there is an atom c such that $c \leq a$ and $c \not\leq b$. But if $c \leq a$ then $c \leq a \oplus b$, by transitivity of \leq (835b) and the definition of \oplus . I.e. $c \leq a \oplus b$ and $c \not\leq b$. Hence $a \oplus b \neq b$.

(843) Definitions of proper part ($<$) and overlap (\circ):

- a. $\forall a \forall b [a \leq b \wedge a \neq b \leftrightarrow a < b]$
- b. $\forall a \forall b [a \circ b \leftrightarrow \exists c [c \neq 0_{\mathcal{A}} \wedge c \leq a \wedge c \leq b]]$

B.1.2 The language of MDPL with a structured domain

The language is that of predicate logic enriched with the function symbol \oplus and the binary relation symbol \leq . Like Dekker (1993), I disregard constants.¹

(844) a. Set V of individual variables;

- b. Function symbol \oplus ;
- c. Set \mathcal{R} of n -ary relation symbols: R_0, R_1, \dots ;
- d. Special binary relation symbols $=, \leq$;
- e. Connectors \neg, \wedge ;
- f. Quantifier \exists .

(845) Terms, T :

- a. Individual variables are terms, $V \subseteq T$;
- b. If t_1 and t_2 are terms, then $t_1 \oplus t_2$ is a term.

(846) Formulas:

- a. 0-ary relation R_0 is a formula;
- b. If R_n is an n -ary relation and t_1, \dots, t_n are terms, then $R_n(t_1, \dots, t_n)$ is a formula;
- c. If t and t' are terms, then $t = t'$ and $t \leq t'$ are formulas;
- d. If ϕ is a formula, then $\neg\phi$ is a formula;
- e. If ϕ and ψ are formulas, then $\phi \wedge \psi$ is a formula;
- f. If ϕ is a formula and x is a variable, then $\exists x\phi$ is a formula;

B.1.3 The semantics of MDPL with a structured domain

The semantics of MDPL is defined with respect to a modal predicate logic model with a structured domain, a triple $\langle \mathcal{D}, W, F \rangle$:

¹Proper names like *Mary* will also be represented by variables (m) with the additional assumption that these variables are introduced automatically at the beginning of each discourse.

- (847) Modal predicate logic model is a triple $\langle \mathcal{D}, W, F \rangle$
- $\mathcal{D} = \langle D_0, \leq \rangle$ is a complete atomic free upper semilattice (with a $0_{\mathcal{D}}$);
 - W is a non-empty set of worlds, $W \cap D = \emptyset$
 - F is an interpretation function that maps n -ary relation symbols to functions from W to sets of n -tuples of individuals from D ,
 $F : \mathcal{R} \mapsto (\mathcal{P}(D^n))^W$

If X and Y are sets, the notation Y^X means the set of all functions from X to Y . If X is a set and n a natural number, the notation X^n means the set product $X \times \dots \times X$ (n times). $\mathcal{P}(X)$ is the power set of X .

The subdomain without a zero will be more useful than the domain with a zero for most further definitions. Thus let $D = D_0 \setminus 0_{\mathcal{D}}$.

- (848) Assignments:
- A *partial assignment* g with domain X is a function that maps variables in $X \subseteq V$ to individuals in D , $g : X \mapsto D$;
 - D^X is the set of all partial assignments with domain X .

An *information state* is a set of *possibilities* each of which is a world-assignment pair $\langle w, g \rangle$

- (849) Information states:
- i is a *possibility* with domain X iff $i \in W \times D^X$;
 - s is an *information state* with domain X iff $s \subseteq W \times D^X$;
 - The set of all information states S_W^X with domain X is the power set of $W \times D^X$: $S_W^X = \mathcal{P}(W \times D^X)$;
 - The set of all information states $S_W = \bigcup_{X \subseteq V} S_W^X$

- (850) Domain function D :
- if g is a partial assignment in D^X , $D(g) = X$;
 - if i is a possibility in $W \times D^X$, $D(i) = X$;
 - if s is an information state in S_W^X , $D(s) = X$.

The interpretation of a formula in MDPL is a function from information states S_W to information states S_W .

- (851) Semantics of MDPL with a structured domain:
- $s \llbracket R(t_1, \dots, t_n) \rrbracket = \{i \in s \mid \langle \text{REF}(t_1, i), \dots, \text{REF}(t_n, i) \rangle \in F(R)(w) \}$
if $t_1, \dots, t_n \in \uparrow_{\oplus}(D(s))$
 - $s \llbracket t = t' \rrbracket = \{i \in s \mid \text{REF}(t, i) = \text{REF}(t', i)\}$ if $t, t' \in \uparrow_{\oplus}(D(s))$
 - $s \llbracket t \leq t' \rrbracket = \{i \in s \mid \text{REF}(t, i) \leq \text{REF}(t', i)\}$ if $t, t' \in \uparrow_{\oplus}(D(s))$
 - $s \llbracket \neg \phi \rrbracket = s - s \llbracket \phi \rrbracket$
 - $s \llbracket \phi \wedge \psi \rrbracket = s \llbracket \phi \rrbracket \llbracket \psi \rrbracket$
 - $s \llbracket \exists x \phi \rrbracket = s[x] \llbracket \phi \rrbracket$ if $x \notin D(s)$

On (851a)–(851c): The reference function REF returns the referent of a term in a given possibility $\langle w, g \rangle$. For simple variables from V it returns the value of the assignment function g for that variable. For terms containing \oplus it computes the referent given the assignment function and the semantics of \oplus .

- (852) Reference function $\text{REF} : T \times S_W^X \mapsto D$
- a. if $t \in X$, $X \subseteq V$, and $i = \langle w, g \rangle$ then $\text{REF}(t, i) = g(t)$;
 - b. if $t = t_1 \oplus t_2$ and $t_1, t_2 \in T$ then $\text{REF}(t, i) = \text{REF}(t_1, i) \oplus \text{REF}(t_2, i)$.

The update in (851a)–(851c) is only defined if all the terms encountered in the formula are composed of variables previously introduced, i.e. variables in the domain (of the partial assignments) of the current information state s .

- (853) Closure under \oplus of set $X \subseteq T$, $\uparrow_{\oplus}(X)$,
is a set of all and only such x that:
- a. $x \in X$; or
 - b. $x = y \oplus z$ such that $y, z \in X$.

On (851f):

- (854) Domain extension:
 $s[x] = \{\langle w, h \rangle \mid \exists i \in s[i = \langle w, g \rangle \wedge g \leq_{\{x\}} h]\}$
- (855) a. $g \leq_x h$ iff $g \leq h$ and $h \in D^{D(g) \cup X}$ (Dekker, 1993, p. 163);
b. $g \leq h$ iff $D(g) \subseteq D(h)$ and $g(x) = h(x)$ for all x in $D(g)$.
(Dekker, 1993, p. 161).

The expression $h \in D^{D(g) \cup X}$ means that h is a function from $D(g) \cup X$ to the domain of individuals D . Assignment h extends assignment g , $g \leq h$, iff the domain of g , $D(g)$, is a subset of the domain of h , $D(h)$, and $g(x) = h(x)$ for all x in $D(g)$, Dekker (1993, p. 161).

On (851d):

- (856) State subtraction (Dekker, 1993, p. 163):
 $s - t = \{i \in s \mid i \not\leq t\}$

We will say that possibility $j = \langle w, h \rangle$ extends possibility $i = \langle v, g \rangle$, $i \leq j$, iff $v = w$ and $g \leq h$.

- (857) Suppose $i = \langle v, g \rangle$ and $j = \langle w, h \rangle$ are possibilities, then:
 $i \leq j$ iff $v = w$ and $g \leq h$

- (858) Restriction and extension:
- a. Possibility i has a restriction in information state s , $i \triangleright s$,
iff $D(s) \subseteq D(i)$ and $\exists j \in s[j \leq i]$
 - b. Possibility i has an extension in information state s , $i \triangleleft s$,
iff $D(i) \subseteq D(s)$ and $\exists j \in s[i \leq j]$

B.1.4 Properties of MDPL

- (859) Update (Dekker, 1993, p. 161):
 t is an *update* of s , $s \leq t$, iff $D(s) \subseteq D(t)$ and $\forall i \in t[i \triangleright s]$
- (860) MDPL is an update semantics (Dekker, 1993, p. 166):
 $s \leq s[\phi]$, if defined

(861) State product and common ground (Dekker, 1993, p. 205):

- a. $s \wedge t = \{i \in W \times D^{D(s) \cup D(t)} \mid i \succ s \text{ and } i \succ t\}$
- b. $s \vee t = \{i \in W \times D^{D(s) \cap D(t)} \mid i \leq s \text{ or } i \leq t\}$

(862) Distributivity (Dekker, 1993, p. 206):

- a. $s[[\phi]] \wedge t[[\phi]] = [s \wedge t][[\phi]]$
- b. $s[[\phi]] \vee t[[\phi]] = [s \vee t][[\phi]]$

(863) Facts:

- a. if $D(s) = D(i)$ then $i \succ s$ iff $i \in s$ iff $i \leq s$ (Dekker, 1993, p. 161);
- b. if $D(s) = D(t)$ then $s \wedge t = s \cap t$;
- c. if $D(s) = D(t)$ then $s[[\phi]] \cap t[[\phi]] = [s \cap t][[\phi]]$;
- d. if $s \subseteq t$ then $s[[\phi]] \subseteq t[[\phi]]$;

B.2 MDPL with a structured domain and exhaustification

B.2.1 The language

The language of MDPL with a structured domain and exhaustification is like the one defined in Section B.1.2, but λ -terms are added. I.e. we extend the set of relations with non-atomic relations.

- (864) a. If ϕ is a formula, then ϕ is a λ -term;
- b. If ϕ is a λ -term and x is a variable, then $\lambda x\phi$ is a λ -term.

B.2.2 The semantics

The semantics is like that defined in Section B.1.3 with three additions. First, we add the standard interpretation for λ -terms. The second addition is a set \mathcal{P} of *meaning postulates*—constraints on the model $\langle \mathcal{D}, F, W \rangle$. Thus \mathcal{P} is a set of formulas, and W contains all and only the worlds in which all these formulas are true (one could assume the standard static notion of interpretation and truth here).

The third addition is the exhaustive mode of interpretation. But first some definitions.

(865) Information replacement:

- $s[X] = \{\langle w, g \rangle \mid w \in X \wedge \exists v \in W[\langle v, g \rangle \in s]\}$,
- where s is an information state and X is a subset of W .

Information replacement is an operation that replaces all the information about the world contained in an information state s by information represented by the set of worlds X , but preserves all the information about the variables contained in s .²

²This operation is needed primarily to get access to an appropriate information state that contains no information beyond the meaning postulates, i.e. $s[W]$, where W is the set of all worlds that conform to \mathcal{P} . In Chapter 6, Section 6.3.3, the initial information state s_0 was used for this purpose, but in the current setting s_0 cannot be used since we do want to preserve the information about the variables.

- (866) Facts:
- a. $s \subseteq s[W]$;
 - b. $s[\phi] \subseteq s[W][\phi]$.

- (867) Exhaustive interpretation:
- $$s[\phi]_{exh}^P = \{i \in s[\phi] \mid \neg \exists j \in s[W][\phi][j <_{P, \mathcal{X}} i]\},$$
- where P is a λ -term, and $\mathcal{X} \subseteq \mathcal{R}$.

We will also use $s[\phi]_{exh}^P$ as an abbreviation for $s[\phi]_{exh}^{\lambda x_1 \dots \lambda x_n [P(x_1, \dots, x_n)]}$ where P is an n -ary relation from \mathcal{R} . The set \mathcal{X} is used as a restriction on the *ceteris paribus* condition in the definition of $<_{P, \mathcal{X}}$ below. Van Rooij and Schulz (2004b, p. 30) use the non-logical vocabulary occurring in ϕ for such a restriction. Note that since \mathcal{X} is a subset of \mathcal{R} , the *ceteris paribus* condition only concerns the primitive relation symbols (no compound λ -terms).

- (868) $\langle w_1, g_1 \rangle <_{P, \mathcal{X}} \langle w_2, g_2 \rangle$ iff $g_1 = g_2$ and $w_1 <_{P, \mathcal{X}} w_2$.

- (869) $w_1 <_{P, \mathcal{X}} w_2$ iff
- a. $F(P)(w_1) \subset F(P)(w_2)$, and
 - b. for all $R \in \mathcal{X}$ such that $R \neq P$, $F(R)(w_1) = F(R)(w_2)$.

We will write $<_P$ for $<_{P, \mathcal{X}}$ and always specify the current convention about \mathcal{X} independently.

This is another possible way to restate the definition of exhaustive interpretation, which will be useful for some computations:

- (870) $s[\phi]_{exh}^P = s[\phi] \cap \min_{<_P}(s[W][\phi])$

- (871) $\min_{<_P}(s) = \{i \in s \mid \neg \exists j \in s[j <_P i]\}$

- (872) $s[\phi] \cap \min_{<_P}(s[W][\phi]) =$
 $\{i \in s[\phi] \mid i \in \min_{<_P}(s[W][\phi])\} =$
 $\{i \in s[\phi] \mid i \in \{k \in s[W][\phi] \mid \neg \exists j \in s[W][\phi][j <_P k]\}\} =$
 $\{i \in s[\phi] \mid i \in \{k \mid k \in s[W][\phi] \wedge \neg \exists j \in s[W][\phi][j <_P k]\}\} =$
 $\{i \in s[\phi] \mid i \in s[W][\phi] \wedge \neg \exists j \in s[W][\phi][j <_P i]\},$
 but $s[\phi] \subseteq s[W][\phi]$, hence
 $\{i \in s[\phi] \mid i \in s[W][\phi] \wedge \neg \exists j \in s[W][\phi][j <_P i]\} =$
 $\{i \in s[\phi] \mid \neg \exists j \in s[W][\phi][j <_P i]\} = s[\phi]_{exh}^P$

B.2.3 Facts

- (873) $s[\phi \wedge \psi]_{exh}^P$ is not necessarily equal to $s[\phi]_{exh}^P [\psi]_{exh}^P$

Conjunction is veridical, i.e. $s[\phi \wedge \psi]_{exh}^P$ entails (is a subset of) $s[\phi][\psi]$:

- (874) $s[\phi \wedge \psi]_{exh}^P = s[\phi][\psi] \cap \min_{<_P}(s[W][\phi][\psi])$

Asyndetic connection is veridical, i.e. $s[\phi]_{exh}^P [\psi]_{exh}^P$ entails $s[\phi][\psi]$:

- (875) $s[\phi]_{exh}^P [\psi]_{exh}^P =$
 $[s[\phi] \cap \min_{<_P}(s[W][\phi])][\psi]_{exh}^P =$
 $[s[\phi] \cap \min_{<_P}(s[W][\phi])][\psi] \cap \min_{<_P}([s[\phi] \cap \min_{<_P}(s[W][\phi])][W][\psi]) =$
 $s[\phi][\psi] \cap \min_{<_P}(s[W][\phi][\psi]) \cap \min_{<_P}([s[\phi] \cap \min_{<_P}(s[W][\phi])][W][\psi])$

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