EXHAUSTIVITY AND INTONATION

A UNIFIED THEORY

MATTHIJS WESTERA

Exhaustivity and Intonation

A Unified Theory

ILLC Dissertation Series DS-2017-03

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The research reported in this dissertation was supported by the Netherlands Organization for Scientific Research (NWO) as part of the research project *The Inquisitive Turn: A New Perspective on Semantics, Logic and Pragmatics.*

Cover design by Malika Buttinger.
Printed and bound by Ipskamp Printing.

ISBN: 978-94-028-0540-6

Exhaustivity and Intonation

A Unified Theory

Academisch Proefschrift

ter verkrijging van de graad van doctor
aan de Universiteit van Amsterdam
op gezag van de Rector Magnificus
prof. dr. ir. K.I.J. Maex
ten overstaan van een door het college voor promoties ingestelde
commissie, in het openbaar te verdedigen in de Agnietenkapel
op donderdag 23 maart 2017, te 10.00 uur

door

Matthijs Westera

geboren te 's-Hertogenbosch.

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Acknowledgments

I wish to express my gratitude foremost to my advisors Jeroen Groenendijk and Floris Roelofsen: thank you for the guidance and freedom you offered throughout my PhD, for the high standard you set, your penetrating criticism and your encouragement. I believe I have been privileged. My gratitude extends to the staff and students of the Institute for Logic, Language and Computation of the University of Amsterdam more generally, as well as to the staff and students of Linguistics at the University of California Santa Cruz, for offering great learning environments and a home. Thanks also to Morgan Mameni, who planted some seeds in an early stage. I am grateful to Maria Aloni, Jörg Peters, Craige Roberts, Robert van Rooij, Martin Stokhof and Michael Wagner for agreeing to be on my doctoral committee.

The work reported in this dissertation has benefited substantially from comments I received in the context of seminars and conferences. Besides the aforementioned institutes, I feel especially but not exclusively indebted in this regard to the linguistics departments of the universities of Düsseldorf, Gothenburg, Göttingen, Nijmegen and Utrecht, McGill University and the Massachusetts Institute of Technology. I am grateful also to the DFG Research Network on Questions in Discourse, and to the reviewers, audiences and organizers of the workshop series on Semantics and Philosophy in Europe (SPE) and Semantics and Pragmatics of Dialogue (SemDial). In these contexts and elsewhere, conversations with Daniel Altschuler, Liz Coppock, Daniel Goodhue, Manuel Križ, Mandy Simons and Peter Sutton have been particularly helpful.

To all whose questions and comments meant more work (I know where to find you): thank you, and I hope that you will find a satisfactory answer in this dissertation.

Matthijs Westera
Amsterdam, January 2017

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Chapter 1

Aims and methodology

> I would like to be able to think of the standard type of conversational practice not merely as something that all or most do *in fact* follow but as something that it is *reasonable* for us to follow, that we *should not* abandon.
>
> (Grice 1989, ch.2, p.29)

1 Aims and structure of this dissertation

This initial section summarily presents the main aims of this dissertation and provides a visual road map. Subsequent sections of this introductory chapter will explain what exactly the object of investigation is (section 2), explicate and motivate some aspects of the general methodology (section 3), and clarify how this dissertation relates to versions published earlier and to the overarching research project *The Inquisitive Turn* (section 4).

1.1 Aims

This dissertation aims to explain and predict what is going on in conversation – e.g., what speakers utter, and how hearers interpret it – in terms of the assumption that speakers and hearers are *rational*. To see how this may work, consider the following dialogue between hypothetical Alf and Beth, henceforth "A" and "B":

(1) A: Of John, Mary and Bill, who is at the party?
B: John and Mary.

(Besides A and B, I will mostly use "*s*he" for a generic *s*peaker, and "*h*e" for a generic *h*earer.) There are various things that we, as an audience, may quite safely conclude from the fact that B produced the utterance she did. For instance, we may conclude that, according to B, John and Mary are at the party. The

presence of this implication can arguably be explained by assuming that (i) in a context like (1) the words "John and Mary" are a rational means for conveying the information that John and Mary are at the party, and (ii) it is normally rational for speakers to provide only information which they take to be true. Vice versa, if we had known beforehand that B thought that John and Mary were at the party, we could have predicted with some certainty that she was going to utter the words "John and Mary", or something in that vein, because nothing else would really have been rational.

Rationality is here intended not as a particular mode of thought (say, conscious and logical), but as a qualification of behavior: that of being in line with one's interests, to the best of one's abilities. The aim to explain complex human behavior in terms of rationality, construed broadly, is common for instance in economy and the social sciences. Within linguistics, and in particular the subfield of *pragmatics*, it can be traced back to the influential work of Grice (1989, ch.2).

This dissertation aims to offer rationality-based explanations for a number of concrete empirical phenomena, centered around two main topics, *exhaustivity implications* and *intonational meaning*, in English and related languages. Both exhaustivity implications and intonational meaning have long been central to pragmatics, and linguistics more generally, but they are not fully understood. I will very briefly introduce these phenomena here, and highlight the main contributions of this dissertation.

Exhaustivity implications Considering again (1), an audience may be entitled to conclude from B's response that the answer she gave is intended to be *exhaustive*, i.e., that according to B, Bill is not at the party. Note that B did not explicitly assert either Bill's absence or his presence. The presence of the implication that he is absent could perhaps be explained by making the plausible assumption that rational speakers provide all the relevant information they take to be true: if B had thought that Bill was at the party, she would have said so. Indeed, this assumption has been the starting point for almost all accounts of exhaustivity implications over the last couple of decades, and it currently still is, despite valid criticism from various angles. This dissertation presents a new account of exhaustivity that overcomes such criticism. This account, *Attentional Pragmatics*, explains exhaustivity not in terms of information-sharing, but in terms of attention-sharing: if B had thought that Bill's presence at the party was at all possible, she would have drawn attention to it. This attentional perspective solves many hitherto unresolved problems, some perhaps in a surprising way, and it enables a new and particularly parsimonious understanding of utterances of interrogative sentences, i.e., questions.

Intonational meaning The implications of an utterance depend on the *intonation* used. For instance, if B's response in (1) is pronounced with a rising pitch

towards the end, as indicated by the pitch track in (2), we may no longer be entitled to conclude that, according to B, (only) John and Mary are at the party:

(2) B: John and Mary? (I'm just guessing!)

Moreover, the same words uttered with a more complex rising-falling-rising contour may imply rather that their relevance is unclear to B, e.g., that B thinks that some underlying question is unclear or left unresolved:

(3) B: John and Mary... (Is this relevant perhaps?)

(This implication of uncertain relevance may result in strangeness in the context of (1) unless some underlying question can be easily imagined.) These are just two examples of a rich and complex empirical phenomenon. Many detailed accounts exist of the use or implications of particular intonation contours, and a number of more general theories exist that aim to cover intonational meaning of English as a whole. However, no reasonably general theory exists that achieves the level of detail and explicitness of the more specific accounts. I will present such a theory, based on the assumption that two central components of English intonation, *boundary tones* and *trailing tones*, are used for indicating whether a certain class of rationality constraints is complied with. This theory of *Intonational Compliance Marking* (ICM) is applied to a considerable range of intonation contours, contributing new insights and reproducing existing notions from more basic assumptions.

The two theories – Attentional Pragmatics and the ICM theory – are closely related: Attentional Pragmatics defines the rationality constraints to which intonation is sensitive according to the ICM theory. Accordingly, they will be integrated within a single, new conceptual and in part formal (logical) framework for characterizing speaker rationality. This framework, *Epistemic Pragmatics*, is essentially a generalized and in some respects streamlined version of existing approaches to pragmatics in the general spirit of Grice 1989 (ch.2), though with more emphasis on and formal explicitness about the speaker's epistemic state, i.e., knowledge and beliefs (hence the name, adopted from a congenial account in Groenendijk and Stokhof 1978). As a framework, Epistemic Pragmatics will not in itself tell us anything about conversation; rather, it offers a certain mode of explanation.

These, then, are the main promises: a general framework for studying conversational rationality, and, defined within the framework, two components of a theory of conversation that together account for numerous phenomena, centered on exhaustivity and intonational meaning.

1.2 Structure of this dissertation

Figure 1.1 depicts the structure of this dissertation. It visualizes the main dependencies that exist between the chapters, i.e., the ways in which understanding later chapters may require first having read some earlier chapter. The stem/branches depict the most substantial dependencies; the vines (thinner) depict less substantial dependencies.

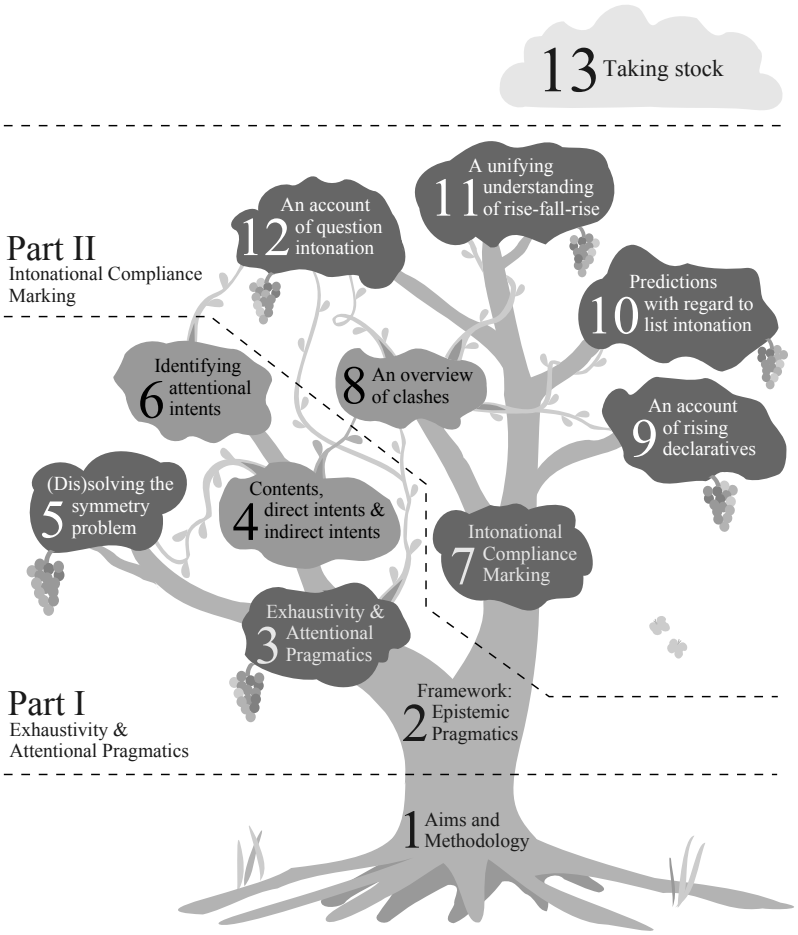


Figure 1.1

For instance, if one is interested primarily in rise-fall-rise intonation (chapter 11), the sequence of chapters 1, 2, 7 is a reasonably self-contained way to get there. However, the vine growing into chapter 11, which originates from chapter 8, indicates that certain details of rise-fall-rise intonation demand some understanding of the range of possible clashes. And the topic of question intonation (chapter 12) can be reached in the same way (via chapters 1, 2, 7), but with additional minor dependencies on chapters 3 and 6 from part I. In general, a safe reading strategy is to take any preferred route upwards along the stem/branches and look back via the vines only when necessary – later chapters will explicitly

refer back to the particular assumptions, definitions and results of earlier chapters on which they rely. Note that simply reading the chapters in order from 1 to 13 is a safe strategy, and, moreover, it will in principle require no backtracking.

About half of the chapters apply the theory to concrete phenomena and provide new solutions to various empirical puzzles. These chapters are depicted with hanging fruits, as rewards for climbing up the tree: in part I, these are chapters 3 and 5, and in part II chapters 9, 10, 11, and 12. Also about half of the chapters play more foundational roles: chapters 1 (current) and 2 explain the aims, methodology and framework, chapters 3 and 7 define the main components of the theory, and chapters 4, 6 and 8 explain several core notions.

Especially the more empirically-minded chapters (the hanging fruits) contain detailed comparisons of the proposed theory to the relevant literature, which will establish that this dissertation substantially advances our scientific understanding of the relevant phenomena. Chapter 13 closes this dissertation with a more general discussion of the scientific merit of the proposed theory, i.e., its parsimony, explanatory power, falsifiability and fruitfulness.

2 The object of investigation

2.1 Between goals, beliefs, and what is uttered

Let a theory of conversation be a set of constraints on the relation between, on the one hand, the speaker's goals and beliefs, and, on the other, the words or sentences she utters. For this relation to be suitable for scientific inquiry, the notions of goals, beliefs and what is uttered must be grounded in observable reality via, on one side, some broader theory of higher cognition, and, on the other side, a theory about which sequences of sounds, shapes or movements correspond to which uttered sentences, taking us from phonetics to phonology, morphology and syntax. This dissertation presupposes the existence of adequate theories of each sort, and aims to connect them by a theory of conversation. The situation is depicted schematically in figure 1.2.

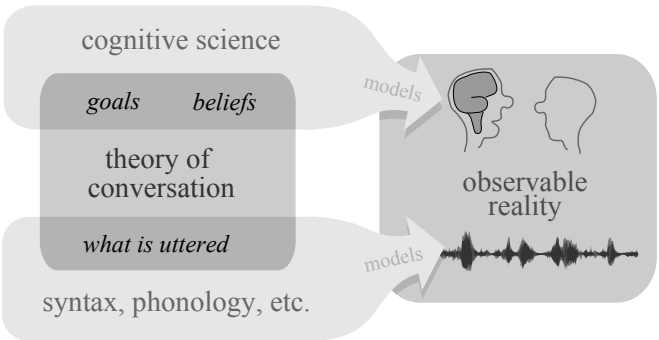


Figure 1.2

When explaining linguistic behavior in terms of speaker rationality, we can traverse the links between goals, beliefs and what is uttered in any direction, e.g.:

- Given a certain goal and a certain set of beliefs, the range of things that a speaker can rationally utter is restricted. For instance, a speaker who believes that it is raining, and whose goal is to answer the question of whether it is raining, will with some probability utter the words "it is raining".
- Given a certain goal and what is uttered, the range of possible beliefs that a rational speaker may have is restricted. Earlier, the exhaustivity implication in example (1) was tentatively explained in this manner: given the goal of establishing who was at the party, and given that B did not say anything about Bill, we may perhaps conclude that she must have believed that Bill is absent (this is not the explanation that I will ultimately pursue).
- Given certain beliefs and what is uttered, the goals that a rational speaker may have are restricted. For instance, if the speaker utters "it's cold in here", and believes that if it is cold one should close the window, the speaker's goal may be to get you to close the window.

More generally, rationality can be conceived of as constraining the relation between a speaker's goals, beliefs and what is uttered.

Grice (1989, ch.2) famously formulated a number of constraints, or *conversational maxims*, to the effect that rational speakers try to be truthful, relevant, sufficiently informative, and clear. To be rational is, roughly, to optimize one's behavior in light of such constraints, e.g., by maximizing the expected number of maxims complied with, plus some kind of preference for complying with more rather than less important maxims in case of a clash. Stated slightly more generally, the following assumption is central to this dissertation:

1.1. Assumption. Participants in a conversation are normally *rational*. To be rational is to maximize expected compliance with a number of constraints on the relation between the speaker's goals, beliefs and what is uttered.

It seems to me that all approaches to pragmatics can be conceived of as subscribing to an assumption along these lines, although some may make this more explicit than others (cf. discourse-centered vs. speaker-centered approaches, to be discussed in chapter 2). I take this to hold also for those approaches that were born out of some kind of dissatisfaction with the Gricean approach, such as Relevance Theory (Sperber and Wilson, 1986b) and game-theoretical approaches (e.g., Franke, 2013).

2.2 Level of analysis

Conversational behavior is or involves a type of cognitive behavior. In cognitive science, it is commonly considered a useful guideline to distinguish three distinct levels of analysis (Marr, 1982):

(i) **Computational:** What does the system, e.g., the speaker, compute, and why?

(ii) **Algorithmic:** How does the system compute it, i.e., by means of which representations and algorithms?

(iii) **Implementational:** How is the system physically realized?

Rationality-based explanations, as illustrated for the exhaustivity implication in (1), reside at the computational level of analysis: to say that speakers and hearers behave in a certain way because it is rational for them is to address the "why"-question. Rationality is a qualification of what is being computed, not of *how* it is being computed. This dissertation will reside almost exclusively at the computational level of analysis.

To restrict ourselves to the computational level of analysis is not to say that the theory should not in some important ways inform theories at the algorithmic and implementational levels of analysis – or vice versa. Indeed, it seems to me a precondition for studying *how* something is being computed to have some idea of *what* is being computed. In the other direction, a complete understanding of what is rational, i.e., an answer to the "why"-question, may in important respects depend on the particular features of processing in a brain, e.g., it may be rational to prefer saying things that are easy to process for oneself or one's audience. For the phenomena under consideration, however, we will see that processing cost is not a crucial factor (mainly chapter 5).

The fields of pragmatics and, closely related, semantics have been predominantly involved with the computational level of analysis – although not always explicitly so, and sometimes implicitly not so, giving rise to misunderstandings and misguided research questions (for discussion see Saul 2002; Bach 2006; Geurts 2011 (ch.4); Geurts and Rubio-Fernández 2015; and Van Tiel and Schaeken 2016). Computational-level pragmatic theories in the line of Grice have long been criticized for being psychologically unrealistic, most notably by proponents of Relevance Theory (Sperber and Wilson 1986b; see also, e.g., Carston 1991; Recanati 2001). But Gricean theories are only potentially psychologically unrealistic if by "psychologically" one means "as pertaining to the algorithmic or implementational level of analysis", where, indeed, they do not not seem to belong (cf. Saul, 2002; Bach, 2006).

An answer to the computational-level "why"-question in terms of rationality raises the question of why rationality is the way it is. One would think that there is a certain principled, largely culture-independent, perhaps evolutionary reason why speakers prefer to, for instance, share and receive only true and relevant information. The question of what this reason is will become more pressing once I start to rely on a particular and considerably more detailed characterization of conversational rationality. Nevertheless, addressing this question lies beyond the scope of the present dissertation. In the absence of an answer, this dissertation is

most safely regarded as an investigation into what the notion of conversational rationality *would have to be like* in order for the phenomena under consideration to be explained in terms of it. Of course, this is not to say that we cannot with some degree of certainty separate plausible from implausible assumptions. The explanatory potential of the constraints to be proposed will reside in their plausibility, and their *in principle* independent falsifiability.

2.3 "Normal" conversation

The theory of conversation to be presented in this dissertation is only a theory of *a certain kind* of conversation – intuitively, those conversations in which the participants are genuine and cooperate towards a certain common goal, namely to find out what the world is like (though this may indirectly serve more practical goals, such as fixing a bicycle). I will optimistically call such conversations "normal", and I will often say, when speaking of such conversations, e.g., that "normally" agents behave in such-and-such a way. I will not further characterize the range of normal conversations, at least not independently of the theory to be presented. What the use of hedges like "normally" commits us to is to be prepared to explain, for any given situation in which the theory turns out to fail, why that situation is a legitimate exception instead of a counterexample to the theory. In any case, I hope to show that the range of normal conversations is quite substantial, and that it expands in certain respects the range of normal conversations according to existing theories.

Within the class of normal conversations, this dissertation is concerned primarily with the way in which interlocutors may share *information* and *attention*, by means of utterances of the intuitive types *assertion* and *question*. Assertions have traditionally been the most prominent type of utterance under consideration in philosophy and linguistics. Over the last couple of decades, increasing attention has been paid also to questions, in part in their role of constraining what can be rationally asserted (e.g., Carlson 1983; Groenendijk and Stokhof 1984; Ginzburg 1996; Roberts 2012; Groenendijk and Roelofsen 2009). To focus on sharing information and attention is not to deny that conversation may serve other purposes, as famously argued by Wittgenstein (1953) and in the literature on *speech acts* (Austin 1962; Searle 1969; Vanderveken 1990; see also Poesio and Traum 1998). But sharing information and attention is particularly basic: at least part of making a promise or issuing a command, and various other types of speech act, is to provide the addressee with a certain piece of information and to draw the addressee's attention to something. This motivates the current focus. I assume that at least some purported types of speech act can be reduced to these more primitive types of speaker intentions (see, e.g., Stokhof and Groenendijk 1976 and Leech 1983, pp.190-191, for early proposals in this vein; cf. Lauer 2013, ch.7).

There may be large classes of "abnormal" situations, from the perspective of the present theory, that are nevertheless related to normal situations in a

sufficiently systematic way for a straightforward translation procedure to render the theory applicable to them. For instance, cases in which a speaker is lying, which are abnormal situations from the perspective of the present theory, could perhaps be covered to a considerable extent by replacing "beliefs" by "pretended beliefs" in an otherwise unmodified theory. Likewise, we could perhaps replace "goals" by "pretended goals" (with some higher-order goals inviting such pretense) in order to cover, for instance, utterances made only for the sake of politeness or for filling the silence (in line with a remark in Grice 1989, ch.2, p.29). For more sophisticated proposals in this direction, see, e.g., Clark and Gerrig 1984 for a pretense-based account of irony, Northrup 2014 (ch.3) for arguments that rhetorical and quiz questions involve pretense uncertainty, or Asher and Lascarides 2013 for an amended Gricean approach to conversations in court.

There are also situations in which the notion of rationality, pretended or actual, is more substantially different from the one to be defined in this dissertation, and in which the mere insertion of, e.g., a layer of pretense may not be sufficient. Situations that come to mind are quite extreme, such as a theater class exercise in which participants are allowed to say only the opposite of what they mean. I hope that at least the clarity and modularity striven for in this dissertation will facilitate future extensions of the theory into these domains.

3 Methodological remarks

3.1 Data and intuition

Two types of data are relevant for an empirical assessment of the theory to be presented: speaker behavior, and an audience's interpretation of that behavior. Regarding the speaker, the theory will predict, for instance, that a speaker who believes that it is raining will not normally say that it *isn't*, or at least will show a certain reluctance when pressed. As for the audience, the theory will predict that an audience witnessing a speaker who says that it is raining, will normally come to believe that the speaker must believe that it is indeed raining. Predictions of the second kind rely on an additional assumption (in addition to the assumption of speaker and audience rationality, i.e., assumption 1.1):

1.2. Assumption. Assumption 1.1 itself is normally a rational one to assume (e.g., a rational audience normally assumes that a speaker is rational).

Recall from the start of this chapter that I framed the two main phenomena in this dissertation, exhaustivity and intonational meaning, in terms of *implications*. The tentative rationality-based explanations proposed there implicitly relied on assumption 1.2.

Grice (1989, ch.14) pointed out that mere *sentences*, in a broad sense, i.e., sequences of words, sounds, or other signs, do not normally warrant any substantial

conclusions about the world; only *utterances* do, in the sense of sentences produced by rational speakers with a communicative intention. For instance, when hearing the sentence "John is at the party" one may conclude that this auditory signal exists and that it was produced by something or someone, and if one is educated in physics one may conclude, moreover, that air was vibrating at certain frequencies. But besides these purely physical consequences nothing can be rationally concluded about the world, e.g., about John or the party, unless the sentence is assumed to be produced in an utterance by a rational speaker, with a communicative intention. This is worth making explicit:

1.3. Assumption. A rational audience will not normally draw any substantial conclusions from witnessing a sentence, except through assuming that it was produced by a speaker in an utterance.

Grice (1989, ch.2) warned us that this can carry over to non-real situations, e.g., situations in which a philosopher is pondering over a certain sentence; Schwarz (1996) extends this warning to psycholinguistic experiments, in which participants may behave *as if* a stimulus sentence was uttered by a rational speaker (in, say, a reasonably typical context; cf. Bolinger 1968; Kadmon and Roberts 1986; Westera and Brasoveanu 2014). This is not to say that participants or we ourselves cannot react to or have intuitions about sentences *as sentences*: we can for instance copy them or count their words. But if someone (say, a linguist) says that "the sentence implies (or entails) such-and-such", either the word "sentence" is being used to mean "utterance" (or "sentence as uttered"), or the word "implies" is being used to mean something other than "warrants drawing the conclusion that". We must be similarly cautious with regard to statements that a sentence would "mean" something, or be "true" or "false".

It is common in the linguistic and philosophical literature to focus on implications of utterances (or of "sentences") rather than on speaker behavior directly. This may be in part for historical reasons, but also because it offers a methodological advantage: whereas predictions about speaker behavior are difficult to test, predictions about implications can be relatively easily tested by presenting made-up examples to an audience. Indeed, one could even, as an author, rely on one's own intuitive judgments regarding a certain sentence or utterance as a source of data. A number of obvious caveats apply to the latter, however. For instance, one should beware that one's judgments may be influenced by one's favorite theory; one should not jump to conclusions about what one's intuitions are intuitions of (Bach, 2002); and one should beware of contextual underspecification (Bolinger, 1968). But every source of data has its caveats, e.g., each of the foregoing may to some extent apply to experimental work as well. As long as we remain aware of the caveats of appeals to our own judgments, the advantages of speedy empirical assessment by authors, readers, and reviewers may often outweigh the risks.

In this dissertation, I will occasionally report my own judgments about a certain example as a source of data. But the role of these reports will be limited – they will primarily serve to illustrate and hopefully make plausible certain more peripheral predictions of the theory. The main contribution of this dissertation is not empirical but theoretical: it offers a unified and explanatory account of several phenomena that appear to be already quite well-known, descriptively, given the reported judgments of previous authors and their informants as well as the occasional experimental study. The only potentially significant empirical contribution, which will serve in chapter 3 to highlight a shortcoming of existing accounts of exhaustivity implications, will be supported by means of the collected judgments of a small number of informants.

A well-known problem for the study of human behavior, regardless of the method of data gathering, is that the human population is heterogeneous, and that it is unclear who the representative humans are whose behaviors could falsify the theory. This issue is analogous to the issue of what "normal" conversations are, and I will not address it any further here. Since almost all examples will be given in English, the class of language users to whom the theory applies will consist primarily of fluent if not native speakers of English. However, the purported non-arbitrariness of rationality, alluded to earlier, is reason to believe that rationality-based explanations generalize particularly well cross-linguistically (which is not to say that there can be no exceptions). But establishing the theory's cross-linguistic potential is not among the current aims.

3.2 The status of auxiliary notions

The relation between goals/beliefs and what is uttered, and the definition of rationality that is supposed to constrain it, can be organized by invoking a number of auxiliary, intermediate notions. For instance, in my brief discussion of example (1) above I invoked the notions of what is said, what is meant, relevance and truth to formulate a possible explanation of the exhaustivity implication, i.e., that a rational speaker would say everything she takes to be relevant and true. There, the auxiliary notions were intended as *ordinary* notions, used in accordance with the conventions of English – or at least sufficiently so for the paragraph to be understandable without first introducing the terms. The explanation of the exhaustivity implication was essentially a *folk-psychological* one.

The literature on pragmatics and semantics features two historically intertwined but (in most cases) clearly distinct strands of approaches, that differ in the status assigned to folk-psychology. The first strand seeks to increase our understanding of the folk-psychological explanation, and of the explanandum itself, by means of a *conceptual analysis* of the ordinary notions, in the spirit of what has come to be known as "ordinary language philosophy" (e.g., Grice 1989, ch.10). The second, more linguistic strand seeks to develop a theory of linguistic behavior,

and regards folk-psychological explanations as a source of inspiration at best. In this strand, the auxiliary notions are not themselves objects of investigation, but simply defined in a way that is useful given the goals of the overarching theory.

I intend this dissertation to belong unambiguously to the more linguistic strand: the goal is a theory of conversation, not a conceptual analysis of the words that ordinary speakers happen to use when conversing about conversation. As such, the folk-psychological explanation of the exhaustivity implication in (1) will be replaced by a more precise, technical one, as will the auxiliary notions that it featured. Although there will be some degree of alignment between the technical and ordinary notions and explanations, this is not a goal in and of itself. This is not to say that the current dissertation may not contribute to the more philosophical strand. Indeed, Grice (1989, ch.2) famously argued that a theory of conversation of the type pursued in this dissertation, i.e., a theory in the more linguistic strand, is a prerequisite for theorizing in the philosophical strand, i.e., conceptual analysis. He criticized earlier work in the philosophical strand for ignoring the possibility that certain intuitions or patterns in language use can be explained in terms of general rationality and should not be blamed on particular features of the concepts of interest.

The status of the auxiliary notions bears on the question of how directly our behaviors and intuitions reflect these notions. Native speakers of English may be able to judge best what the "meaning" of a sentence is, or whether it is "true" in a certain context, in the ordinary senses of "meaning" and "true". But it is not a priori clear what such judgments, if anything, might tell us about the "meaning" or "truth" of a sentence in a technical sense, i.e., in a sense that is useful for a theory of conversation. The only way to assess the adequacy of a theory-internal, technical notion is by its contribution to the adequacy of the theory as a whole, as measured at the theory-external nodes, i.e., beliefs, goals and what is uttered. We must be skeptical, as Bach (2002) argues following Grice (1989, ch.2), of "seemingly semantic intuitions", i.e., intuitions that one is prone to misconceive as being directly about the technical notion of semantic content (to be introduced in chapter 2).

3.3 Parsimony and convention minimalism

A rationality-based explanation of some individual's behavior ends at their reliance on some convention or other. For instance, the reason why an English speaker would use "horse" to refer to horses, is that everybody does it that way, and that doing the same facilitates communication. But we could be more ambitious and aim for a population-level theory of conversation, in which case the next "why"-question would present itself: why are conventions the way they are? Addressing this question would require a diachronic perspective – e.g., "horse" evolved, under such-and-such pressures, from Proto-Indo-European "*ḱers", meaning "to run" (e.g., Köbler, 2014). And this answer, of course, triggers another "why".

It is not always clear, from the outset, whether a given phenomenon can be explained without having to invoke a particular linguistic convention. Throughout this dissertation, by way of a methodological heuristic *convention minimalism*, I will consider appeals to linguistic convention a last resort. This serves two purposes. One is therapeutic: the heuristic forces us to consider speaker rationality before we try anything else, and this will help to avoid the potential confusion between sentences and utterances/speakers that Grice (1989, ch.2) warned us about. The other purpose is methodological: convention minimalism helps achieve theoretical parsimony. Rationality-based explanations that do not rely on particular conventions are parsimonious, because in principle one gets the notion of rationality for free, whereas appeals to convention trigger another "why"-question, i.e., they leave something to be explained at the population level.

As I hope to show, the primary phenomena targeted in this dissertation – exhaustivity implications and intonational meaning – can be explained to a large extent without non-trivial appeals to linguistic conventions. Strictly speaking, this dissertation will not show that implications like exhaustivity are not conventionally associated with certain expressions, in some sense, but rather that they *need not be*, i.e., that a linguistic community with such conventions would be expected to behave no differently from a linguistic community without.

The notion of conversational rationality that I will define could turn out to be somewhat idealized: actual speakers may not always be rational in the way to be defined. But this will not necessarily rid the theory of explanatory potential. As long as speakers at least tend to behave more rationally rather than less, in the sense to be defined, these tendencies can accumulate, diachronically, and result in linguistic conventions that are indistinguishable from how an idealized rational speaker would have behaved (see, e.g., Griffiths and Kalish 2007). In this way, even if the heuristic of convention minimalism could potentially lead me to embrace an idealized notion of rationality, a shift in perspective may save the day. At worst, by adopting the heuristic of convention minimalism, I will have made the job harder than it needed to be.

Lastly, Grice captured a heuristic like convention minimalism in his "Modified Occam's Razor":

> [...] one should not suppose what a speaker would mean when he used a word in a certain range of cases to count as a special sense of the word, if it should be predictable, independently of any supposition that there is such a sense, that he would use the word (or the sentence containing it) with just that meaning. [...] In accordance with the spirit of Modified Occam's Razor, we might attribute conventional meaning to stress only if it is unavoidable.
>
> (Grice 1989, ch.3, pp. 47–48,51)

Note that it is a bit misleading to frame this heuristic, as Grice initially does, as a choice between special senses and rationality-based explanation. The two will not normally be descriptively equivalent: assuming a special sense does not yield predictions unless it can be explained when that sense rather than another would be rationally used. Ambiguity is not a replacement for a rationality-based explanation; at best it would be a possible starting point.

4 Prior publications and *The Inquisitive Turn*

An earlier version of Attentional Pragmatics was published in Westera 2012 and Westera 2014a. This approach was reformulated and improved in certain ways in Westera 2013b (not peer-reviewed), by more clearly separating the informational from the attentional aspects of an utterance. The current dissertation presents a further refined and more generally applicable formulation of the latter (chapter 3). Moreover, the theory is now embedded in a more explicit conceptual and formal framework (Epistemic Pragmatics; chapter 2), and it is more extensively motivated and illustrated (chapters 4, 5, and 6). The theory of Attentional Pragmatics as formulated in chapter 3 was recently presented at the conference *Sinn und Bedeutung* (Westera 2016).

As for the ICM theory, an earlier version was published in Westera 2013a and Westera 2014b. In the current dissertation this theory is presented more clearly and related more thoroughly to the extensive literature on the topic (chapter 7), but its essence remains unchanged. However, its current integration with an improved Attentional Pragmatics enables a more detailed account of several complex phenomena, solving a broad range of empirical puzzles in ways that the aforementioned publications could only hint at (chapters 9, 10, 11 and 12).

The research reported in this dissertation is part of the NWO-funded project *The Inquisitive Turn*. The core assumption in this project, which it shares with other strands in the literature, is that conversation is not just about sharing information but also about sharing conversational goals, for instance by raising an issue or by drawing attention to certain relevant possibilities. The Inquisitive Turn stands out from most of the literature in treating information-sharing and goal-sharing on equal footing, both conceptually and technically: conceptually in the sense that both are conceived of as components of a speaker's communicative intention, or what a speaker "means"; technically in the sense that the project aims to model both components with the same formal rigor. This dissertation wholly subscribes to this aspect of the project.

Within The Inquisitive Turn, two types of communicative intention have been explored that may serve goal-sharing: *raising issues* and *drawing attention to things*. Both notions were formalized in Ciardelli 2009, namely as *(basic) inquisitive semantics* for raising issues (following, e.g., Mascarenhas 2009; Groenendijk and

Roelofsen 2009), and *attentive semantics* (or unrestricted inquisitive semantics, possibility semantics, or highlighting) for drawing attention to things. The logical foundations and some linguistic or philosophical applications of these systems have since been further developed, for instance in Ciardelli, Groenendijk, and Roelofsen 2015b, Roelofsen 2013b, Ciardelli 2016, and Ciardelli and Roelofsen 2015a for inquisitive semantics, and in Ciardelli, Groenendijk, and Roelofsen 2014, Westera 2012; Westera 2013b; Westera 2014a, and Roelofsen 2013a for attentive semantics; both notions are used side-by-side in, e.g., Roelofsen and Van Gool 2010; Roelofsen and Farkas 2015. For a more complete overview I refer to Ciardelli, Groenendijk, and Roelofsen 2015a and to the project website (`https://illc.uva.nl/inquisitivesemantics/`). Work outside the project that uses similar notions and techniques (e.g., Hamblin/Alternative Semantics, dynamic semantics) will be pointed out when relevant in subsequent chapters.

This dissertation presents a theory of conversation that centers on the roles of information and attention, so it belongs to the attentional strand of The Inquisitive Turn. One reason for this focus is that, as I mentioned earlier, sharing attention seems to be particularly basic, e.g., one cannot successfully raise an issue without also drawing the addressee's attention to it (or, say, to its possible answers). A more concrete reason for pursuing the attentional strand here is that its core notion is more fine-grained, in a way that is necessary for the aims of this dissertation, as will become clear in subsequent chapters. (Slightly more precisely: the issue-centered strand of the project models only the *weakest* pieces of information that speakers are interested in, but for an account of exhaustivity we need to model *all* of them.)

Although this dissertation belongs to the attentional strand of the project, it deviates from previous work in this strand, as well as from the rest of the project and from much work in linguistic semantics in general, in having a greater emphasis on rationality-based explanation, a more consistently maintained distinction between sentences and utterances/speakers, and an explicit denunciation of ordinary language philosophy and supposedly semantic intuitions. A more concrete consequence is that the objects that attentive semantics (and also inquisitive semantics) assigns to sentences will here be conceived of primarily as aspects of utterances, which bear on the semantic contents of the uttered sentence only indirectly.

Part I

Exhaustivity and Attentional Pragmatics

Chapter 2

Framework: Epistemic Pragmatics

> So there is that part of syntax and there certainly is pragmatics in some general sense of what you do with words and so on. But whether there is semantics in the more technical sense is an open question. I don't think there's any reason to believe that there is.
>
> (Chomsky, 2000, p.73)

1 Introduction

A characterization of conversational rationality consists in a set of constraints on the relation between goals, beliefs, and what is uttered, together with an account of how speakers optimize their behavior in light of these constraints (assumption 1.1, chapter 1). This chapter presents a conceptual and in part formal framework in which such constraints can be formulated, based primarily on Grice 1989 (ch.2), but incorporating also more recent notions and techniques from the fields of pragmatics and semantics. The formalism used is *Intensional Logic* (Montague 1973; as presented in Gamut 1991, vol.2), enriched with notions like *common knowledge* from the field of epistemic logic. The resulting framework, *Epistemic Pragmatics*, forms the backbone of this dissertation.

At the heart of Epistemic Pragmatics lie three auxiliary notions that serve to subdivide the relation between goals, beliefs and what is uttered into more manageable parts, only some of which will be formalized. The notions that I adopt are *content*, *intent* and *theme*, which generalize the commonly used notions of *sentence meaning* and *speaker meaning* (Grice 1989, ch.6) and *question under discussion* (Roberts 2012, originally published in 1996; Ginzburg 1996), in ways to be explained. Centered on generalizations of these common notions, the whole framework is essentially a generalized and streamlined version of existing frameworks, with major differences only in emphasis and formal explicitness.

One such difference (in emphasis and explicitness) is the *speaker-centrality* of the current framework, compared to the *discourse-centrality* of most existing frameworks. (The term "speaker-centrality" is not intended to be in opposition with "hearer-centrality"; a term like "agent-centrality" might have reflected this better, but it sounds a lot more vague.) In the current, speaker-centered framework, rationality is conceived of as constraining the relation between what a speaker utters and the speaker's goals and beliefs; in a discourse-centered framework, something like rationality is conceived of as directly constraining the range of possible discourse structures, say, sequences of utterances. To illustrate the difference:

(1) A: Who is at the party?
B: John is there.

It would be tempting, and most certainly true at some level, to say that this discourse is rational (or, say, smooth, or felicitous) because the second utterance provides an answer to the first. This is a discourse-centered explanation, because it is framed directly in terms of a certain permissible relation holding between two utterances. In the speaker-centered framework to be presented here, it will be impossible to (directly) state this type of explanation. Rather, we must first invoke a theory of goals and beliefs to determine that B's primary goal, given the context of B's utterance, will be to address A's question, and then we can say that B's utterance is rational because it achieves that goal. This is of course the same explanation, but it is more explicit about an important link: the speaker.

Some discourse-centered approaches (to varying degrees) are Roberts 2012; Ginzburg 1996; Groenendijk 1999; Büring 2003; Asher and Lascarides 2003; Groenendijk and Roelofsen 2009. Although Roberts (2012) and Ginzburg (1996) do take goals and beliefs into account, these are primarily the goals and beliefs that are *common* among the dialogue participants. Ginzburg (1998) moves towards a more speaker-centered approach by distinguishing "private" and "public" features of the context and representing each individual's take on the discourse (cf. Ginzburg 2012), but not in a way that prevents formulating a discourse-centered explanation for (1). Similarly, the approach of Asher and Lascarides (2003) is in part speaker-centered, but a central constraint they assume is that rational speakers try to maximize discourse coherence, a notion framed in terms of an inventory of permissible relations on utterances. (For an earlier, similarly mixed perspective see, e.g., Grosz and Sidner 1986.) More recently, Farkas and Bruce (2010) model the public commitments of individual speakers, but not their epistemic states in full (cf. Gerbrandy 1999), nor their individual goals. As I said, these seem to me only differences in emphasis or explicitness: most discourse-centered accounts also invoke some speaker-centered constraints on the side (e.g., the Gricean maxim of Quality), and even those constraints which are genuinely discourse-centered still tend to be understood and motivated informally in terms of speaker rationality.

There are some reasons for adopting a speaker-centered framework in general, and for doing so in particular in this dissertation. In general, (i) one needs a speaker-centered framework to properly explicate the informal justifications given for discourse-centered constraints in the literature, i.e., derive them from more basic assumptions; (ii) leaving the speaker implicit by "fossilizing" aspects of their rationality into constraints on utterances might make one prone to oversimplify, and even to confuse speakers with sentences (Grice 1989, ch.2); and, relatedly, (iii) a speaker-centered approach is better suited for capturing the distinction between sentence meaning and speaker meaning. For this dissertation in particular, a speaker-centered approach will be convenient given the main phenomena to be considered, i.e., exhaustivity implications and intonational meaning. For instance, (iv) a proper understanding of exhaustivity implications requires that we reason about the speaker's epistemic state; and (v) the intonation used by a speaker has long been noted to be indicative of their commitment to or uncertainty about, say, the truth or relevance of their utterance.

Outline Section 2 introduces the auxiliary notions of content, intent and theme, and, based on these, divides the framework into three more manageable parts: semantics, rheme-pragmatics and theme-pragmatics. Section 3 introduces the rheme-pragmatic component of the framework and its formalization in Intensional Logic. For the sake of concreteness, a small set of rationality constraints will be defined, essentially the Gricean (1989, ch.2) maxims. These already form a part of the rheme-pragmatic component of the theory of conversation that will be expanded in subsequent chapters. Section 4 introduces the theme-pragmatic part of the framework, and already presents the entire theme-pragmatic part of the theory, which consists in only a handful of constraints. Section 5 concludes.

2 Auxiliary notions and general architecture

2.1 Contents and intents

Grice (1989, ch.6) pointed out that sentences mean things, that speakers mean things by uttering sentences, and that sentence meaning and speaker meaning (or utterance meaning) may diverge in various ways. Grice's subdivision of meaning pertained primarily to the ordinary language notion of meaning, i.e., it belonged with the more philosophical strand (chapter 1). However, he drew a similar distinction when developing a theory of conversation (1989, ch.2), namely between what is said or "made as if to say" in an utterance and what is meant. A distinction of this sort has been central to much of semantics and pragmatics since.

Speakers do more with language than "mean" things, in some intuitive sense, e.g., they also ask things, command things, and, central in this dissertation, draw attention to things. This variation calls for a pair of auxiliary notions that

generalize the notions of sentence meaning and speaker meaning in a natural way. Loosely following Bach and Harnish 1979, I will use the terms "content" and "intent" to this end:

2.1. Assumption. **Contents and intents**:
Words and sentences have *contents*; utterances have *intents* (and they also "have" contents, namely those of the uttered sentence).

The term "content" is frequently used in the literature, where it may mean either content or intent, or even any piece of information, paralleling the unfortunate ambiguity of the word "meaning" (and contrary to many languages which do mark the distinction, e.g., in Dutch, sentences "betekenen" while speakers "bedoelen"). It is not always clear what is meant on such occasions, as a consequence of which the confusion between sentences and speakers that Grice addressed has not been altogether eliminated. Assumption 2.1 will avoid this.

This dissertation will revolve primarily around what I call "informational" and "attentional" intents and, less centrally, contents. I will, for now, introduce only the informational notions, and leave the attentional counterparts to subsequent chapters. An informational content is to be conceived of as (a part of) the literal meaning of the words or sentence uttered (but in a technical sense that is subject to the heuristic of *convention minimalism*, cf. chapter 1).

An informational intent is to be thought of as a piece of information that a speaker intends to share with the audience. One or several informational intents together may correspond roughly to the traditional notion of speaker meaning. To illustrate, consider the following example:

(2) A: Everyone is laughing!

A plausible informational content for the sentence could be the proposition that everyone is laughing. A plausible informational intent for the utterance could be a slightly more qualified version of that, e.g., that everyone *who is currently present* is laughing, say, John, Mary and Bill. And perhaps there is an additional intent to the effect that A is happy or annoyed about that fact. Of course, what exactly the contents and intents of an utterance are can only be determined by assessing the predictions of the theory as a whole.

Both contents and intents are distinct from *implications*, like the exhaustivity implication illustrated in chapter 1. A successful utterance does not necessarily imply the truth of its contents or intents, only their existence. Conversely, an utterance may imply many things that are neither intended to be conveyed by the speaker nor entailed by the uttered sentence's content. For instance, given the sound of a speaker's voice an utterance may potentially convey that the speaker is female and that she was breathing out while speaking, but such information will only in very peculiar circumstances have been intended to be shared by

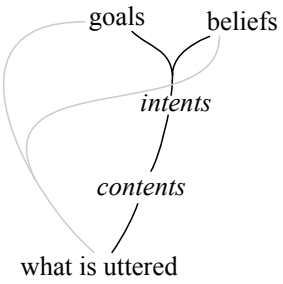


Figure 2.1

those means. I will call the totality of what is implied, directly or via contextual knowledge, the "informational potential" of an utterance.

Grice (1989, ch.5) noted that not every piece of information that is intended to be conveyed is part of what is meant by the speaker (at least in the ordinary sense of "meant"). There must be a particular type of intention, a "communicative intention", that has the special feature that it must be intended to be recognized as an intention. It is this sort of intention that I assume must underly an intent, but the precise nature of communicative intentions compared to other types of intentions will not play an important role in this dissertation.

The auxiliary notions of content and intent subdivide the relation between goals, beliefs and what is uttered (figure 1.2 in chapter 1), as in figure 2.1. The notion of rationality, which constrains this relation, can likewise be subdivided: some aspects of rationality will constrain which intents are appropriate given certain goals and beliefs, and others will constrain, via the notion of content, which sentences are best used for clearly communicating those intents. It may be that rationality imposes constraints on the relation between goals, beliefs and what is uttered that cannot be naturally framed in terms of the notions of content and intent. This is why figure 2.1 also includes the uninterrupted gray lines, bypassing everything. But these will not play a role in the current dissertation.

Speaker rationality will not primarily be characterized in terms of what the contents, intents and goals of an utterance really are, but in terms of what the speaker takes them to be. The entire diagram of figure 2.1 must be understood to exist, as it were, inside the speaker's belief state (and the "beliefs" node itself can be understood more narrowly, as beliefs about the external world). This will become more clear when presenting the formalization. Formulating rationality in terms of the speaker's beliefs about the contents and intents of their utterance does not imply that a speaker should be aware of those beliefs or be able to introspectively distinguish beliefs about contents from beliefs about intents, or either of these from beliefs about the context or various implications of an utterance. That is, speakers are not assumed to have conscious direct access to the auxiliary notions of the theory (cf. chapter 1, section 3.2).

2.2 Themes

In chapter 1, I restricted the scope of this dissertation to conversations in which the goal is to find out what the world is like. I will assume that this type of conversation can be adequately modeled as being centered around the goal(s) of making certain relevant pieces of information *common ground* (although this could potentially derived from the in some sense more primitive goals of getting and providing information). I will conceive of the making common ground of a certain piece of information as a goal in itself, i.e., if n pieces of information are worth sharing, then there are n goals. A given utterance may potentially serve any number of these goals simultaneously, e.g., by providing or inviting several pieces of information.

I assume that conversational goals are organized into what I call "themes":

2.2. Assumption. **Thematic organization of goals**:
The goals that an utterance may serve are organized into *themes* – non-empty sets of goals – on the basis of (a.o.) subject matter and importance; intents are aimed at entire themes, not individual goals.

The motivating idea is that a speaker who pursues a certain goal, say, to make it common ground that John was at the party, may depending on the context reasonably be expected to simultaneously pursue other goals that pertain to the theme of "party attendance", say, to make it common ground that Mary or Bill was at the party. Indeed, something of this sort was presupposed by the informal explanation of the exhaustivity implication in (1) of chapter 1, repeated here:

(3) A: Of John, Mary and Bill, who are at the party?
B: John and Mary. (implied: B believes Bill isn't.)

The intuitive explanation given in chapter 1 was that if B had thought that Bill was at the party, she would have said so. In the current terminology, the reason for this is that the goal of establishing Bill's presence is part of the theme of B's utterance – a theme that is in some way inherited, of course, from A's question.

The role of themes in the overall theory is depicted in figure 2.2, which is obtained from figure 2.1 by inserting the notion of theme in between goals and intents, and by adding some gray areas and labels that I will explain further below. Given a certain set of goals, conversational rationality will constrain how these are to be organized into themes and which themes a speaker may choose to address first; and given a certain choice of themes, rationality will constrain which intents an utterance addressing those themes may have, and by means of which contents those intents can be clearly conveyed. Vice versa, understanding the contents and intents of an utterance will tell us something about the themes and goals pursued.

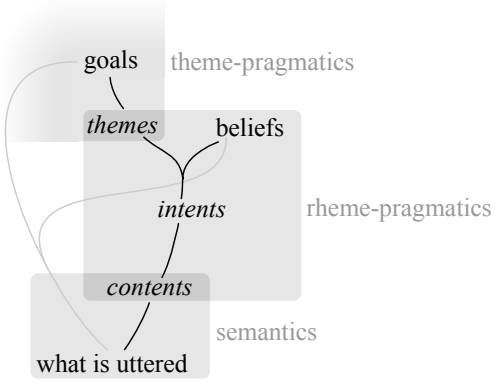


Figure 2.2

The notion of theme resembles the notion of *question under discussion* in much existing work (e.g., Roberts 2012, building on Carlson 1983). I use the word "theme" mainly in order to avoid, in line with the current speaker-centeredness, a too direct association between conversational goals and questions as a type of utterance. Certainly, a main purpose of questions-as-utterances is to set conversational goals for an addressee – but assertions may do the same. In the current approach, both assertions and questions (as types of utterances) have certain contents and intents, and are aimed at certain themes, which organize the conversational goals. For both questions and assertions, the relation between goals and contents is not direct, but mediated by the notion of intent and by considerations of speaker rationality.

For the same reason I also wish to avoid a direct association between the organization of conversational goals and the semantic contents of interrogative sentences (see chapter 6). Certain constraints have been argued to hold on the semantic contents of interrogatives that may not be adequate when imposed on the way in which we organize our goals, i.e., themes. For instance, Groenendijk and Stokhof (1984) develop a theory of the contents of interrogative sentences according to which these are *partitions*, i.e., sets of complete, exhaustive answers. But they themselves already note (p.371) that organizing the conversational goals like a partition gives rise to a problem for accounts of exhaustivity implications (to be discussed in chapter 5). More recently, the semantic contents of interrogatives have been argued to be *downward-closed* sets of propositions (Ciardelli, Groenendijk, and Roelofsen, 2013). If we translate this directly to the thematic organization of conversational goals, it would mean that different pieces of information that are to be made common ground are necessarily logically independent, which may be a questionable restriction – or at least its motivation as far as semantic contents go does not automatically transfer to the organization of conversational goals.

Moreover, in the current methodology there is no way to identify the contents of interrogatives prior to making assumptions about the organization of goals –

and explanatorily that would arguably be the wrong order as well: to the extent that linguistic conventions evolved to serve our communicative needs, the rational organization of goals is explanatorily prior to the conventional use of interrogative sentences. Presumably we would organize our goals in a sensible way also when, say, fixing a bike, based in part on something like subject-matter; we would perhaps first pursue all goals related to the chain and gears, then everything related to the position of the cyclist (saddle, handlebars), and so on.

2.3 Three modules

It will be convenient to divide the framework, and the theory of conversation, into three modules, denoted by the gray regions in figure 2.2: *theme-pragmatics*, *rheme-pragmatics* ("rheme" = that which is said about the theme), and *semantics*. Theme-pragmatics accounts for the selection of goals and their organization into themes, rheme-pragmatics determines which intents and contents are appropriate for an utterance given the theme and the speaker's beliefs, and semantics determines by means of which sentences these contents can be expressed.

It follows from the technical nature of the auxiliary notions that semantics alone does not yield any predictions, and neither do rheme-pragmatics or theme-pragmatics on their own. This corresponds to what Leech (1983) calls a "pragmaticist" stance, according to which semantics is only a part in a larger theory of conversation. It is in line with Grice 1989 and much work in pragmatics (but also, for instance, Chomsky 2000). Nevertheless, several alternative characterizations of semantics and pragmatics exist. For instance, what Leech calls the "semanticist" stance maintains that one can do semantics without worrying too much about conversation, for Gazdar (1979) pragmatics is solely concerned with non-truth-conditional aspects of meaning, and for Sperber and Wilson (1986b) pragmatics is primarily about the process of utterance interpretation. I refer to Bach, 1997 for an overview of many characterizations of pragmatics that have been proposed, and for a discussion of potential misconceptions that could underly at least some of those different from the current one; I refer to Stokhof 2011 for criticism of a traditional instantiation of what Leech calls the "semanticist" stance, namely the view that the object of investigation for semantics would be (certain types of) speaker intuitions.

In this dissertation, pragmatics is further divided into theme-pragmatics and rheme-pragmatics, which corresponds basically to the distinction between choosing goals and choosing adequate means to pursue those goals. This distinction may be implicit in the literature: attempts to explain implications like exhaustivity tend to simply presuppose a certain goal (or theme, or question under discussion) and start from there, effectively concentrating on rheme-pragmatics, whereas attempts to explain discourse coherence seem to be more interested in the transition from one goal to the next (e.g., rhetorical relations; Asher and Lascarides 2003), i.e., theme-pragmatics. More explicitly, Hobbs (1996) draws a similar distinction between

"global" pragmatics, which would relate an utterance to the participants' ongoing plans, and "local" pragmatics, which would operate more within the scope of single utterances, dealing with, e.g., ambiguity and anaphora resolution. Throughout this dissertation I hope to show that the distinction between rheme-pragmatics and theme-pragmatics is particularly useful.

In the remainder of this chapter I will introduce some basic components of the rheme-pragmatic and the theme-pragmatic part of the theory, filling some slots in the framework. Both parts will consist of a number of rationality constraints. I will call the rheme-pragmatic constraints "maxims", following Grice 1989 (ch.2), and the theme-pragmatic constraints "principles", solely to mark the distinction. The (rheme-pragmatic) maxims will roughly follow Grice's recipe as far as informational intents go, i.e., there will be maxims demanding that one's informational intent be true, relevant, sufficiently informative and clearly conveyed. The (theme-pragmatic) principles will include, just to give an impression, criteria for organizing goals into themes, the introducing of strategic goals when a prior goal cannot be directly achieved, and pruning goals that can no longer be reached. The maxims will be rigorously formalized; the principles will be characterized more informally, but in sufficient detail for the purposes of this dissertation.

As for the semantic part of the theory, I will leave it mostly implicit, except in chapter 6 on attentional contents and intents. I will generally presuppose that a suitable semantic theory could be defined to deliver the assumed contents, or, if I leave the contents implicit altogether, to deliver some contents that are appropriate for conveying the assumed intents. Most utterances will be sufficiently simple for this to be a safe strategy. In line with the heuristic of convention minimalism, I will not, of course, assume as part of the semantic content of a sentence implications such as exhaustivity, that I wish to explain otherwise.

3 Rheme-pragmatics

3.1 Formalization: Intensional Logic

Throughout this dissertation I will often state formally (i.e., in a formal, logical language) what I assume to be the themes, intents and contents of a particular utterance. Consider for instance B's response in (3) above, repeated here with such a formalization.

(4) B: John and Mary (are at the party).

$\mathcal{T}_0 = \{^Pj, ^Pm, ^Pb, ^Pjm, ^Pjb, ^Pmb, ^Pjmb\}$
$\mathbb{p}_0 = ^Pjm$
$\mathbb{p}_0 = ^Pjm$

The formalism will be explained shortly, but I will run through this example to give a first impression. The constant $\mathcal{T}_0$ denotes the main theme of the utterance, i.e., the theme with highest precedence, which in this case is assumed to contain various propositions that are worth sharing, namely that John is at the party ($^{\wedge}Pj$), that Mary is at the party ($^{\wedge}Pm$), and so on, up to everyone of John, Mary and Bob being at the party ($^{\wedge}Pjmb$). Intuitively, then, the theme is "party presence among John, Bill and Mary" or "who of John, Bill and Mary is at the party". The constant $\mathbb{p}_0$ denotes the main informational content of the uttered sentence, say, its literal meaning, which in this case is the proposition that John and Mary are at the party ($^{\wedge}Pjm$). (Perhaps a case could be made that the absence of the parenthesized part in (4), a case of *ellipsis*, would make the content of the sentence semantically incomplete as well. I will remain neutral on this topic.) Lastly, p_0 denotes the main informational intent of the utterance, say, the speaker meaning, which in this case is assumed to be the same as the content, i.e., the sentence is being used literally. Of course, it remains to be seen whether these assumptions will suffice for an account of, say, the exhaustivity implication of (4), i.e., that B believes that no one else is at the party (chapter 3); and perhaps there are additional intents as well, besides the one that is conveyed most directly by means of the informational content (e.g., chapter 4).

As is common in semantics, I will model propositions as functions from worlds to truth values, or, equivalently, as *sets of worlds*, namely those worlds for which the function returns true. For instance, the proposition that John is at the party (denoted by $^{\wedge}Pj$) returns true when given a world in which John is at the party, and false otherwise (equivalently, it is the set of worlds in which John is at the party). Accordingly, the theme denoted by $\mathcal{T}_0$ is a set of propositions, hence a set of sets of worlds. These worlds must be understood as theory-internal entities (though available at the interface with a presupposed theory of goals), just like the notions of content, intent and theme themselves.

Recall that intents are to be conceived of as objects of communicative intentions: a speaker intends to communicate the intent. The intentions themselves are not explicitly represented in (4), only their objects, i.e., what is intended to be communicated. Likewise, a theme is to be conceived of as a way of organizing conversational goals, but the set assigned to $\mathcal{T}_0$ in (4) represents only the objects of those goals, i.e., the propositions that ought to be made common ground. This is a simplification: what is formally represented will have just enough structure for present purposes, i.e., it will let us formalize the main rationality constraints of interest, but not much more than that. For present purposes this simplification will be convenient, but it may ultimately have to be given up. For more explicit accounts of goals and intentions that could potentially be plugged in, see, e.g., Cohen and Levesque 1990; Asher and Lascarides 2003.

The formalism used is *Intensional Logic* (Montague, 1973), traditionally used in formal semantics, with some additional notation conventions and a small number of extensions from the field of epistemic logic. Because the formulas used throughout this dissertation (e.g., in (4) above) will generally be quite simple, hopefully intuitive, and mostly easy to paraphrase in English, no deep understanding of the formalism itself will be necessary to appreciate the contents of this dissertation. The aim of this section is only to enable the reader to at least see how, in subsequent examples and theorems, the formal expressions relate to the English paraphrases that I will often give. I presuppose familiarity with at least predicate logical notation. The precise syntax and model-theoretic interpretation of Intensional Logic are defined in detail in appendix A, essentially following the exposition in Gamut 1991 (vol.2), but with some additional notational shorthands (e.g., the usual set-theoretical notation, relied upon already in (4)).

For readers familiar with Intensional Logic and its traditional role in formal semantics, it should be clear from (4) that the role of Intensional Logic in this dissertation is substantially broader. In formal semantics Intensional Logic has been used for representing and compositionally deriving the contents (meanings) of sentences. In this dissertation, Intensional Logic is likewise used for describing the contents of sentences (e.g., $\mathbb{p}_0$ in (4)), and a compositional account of contents could be plugged in, but it will be used more centrally for describing the themes and intents of utterances, and for defining the constraints that rationality imposes on these objects.

Expressions Intensional Logic is a form of *type theory*, which means that all expressions are of a particular type. The possible types are e for individuals, t for truth values, and, for any types α and β, $\langle\alpha,\beta\rangle$ for functions from things of type α to things of type β, and $\langle s,\beta\rangle$ for functions from worlds to things of type β. As is common, constants and variables of certain relevant types will be distinguished alphabetically and/or typographically. Table 2.1 lists some constants and variables that will be commonly used, together with their type and their role in the theory. Appendix A contains a more complete table, as well as an explanation of the "varying"/"mixed" types in the bottom rows. Some of these constants and variables were used already in (4) to specify the content, intent and theme. Also worth highlighting are the constants reserved for the set of all informational contents of the utterance ($\mathbb{I}$), the set of all informational intents ($\mathcal{I}$) and the set of all themes of the utterance ($\mathscr{T}$). These constants will enable us to quantify over all intents, contents and themes of an utterance, which is necessary to state rationality constraints like "every intent addresses an appropriate theme" and "every content serves to communicate an appropriate intent".

Constants and variables can be combined into complex expressions, insofar as their types permit, by means of the usual truth-functional connectives ($\wedge$, $\vee$, etc.), quantifiers ($\forall$, $\exists$), and function application (e.g., $P(j)$), three predicate-logical

Type	Variables	Constants	Usage
e	x, y, z	$j, m, b, \ldots$	individual
t, $\langle e, t\rangle$, $\langle e, \langle e, t\rangle\rangle, \ldots$		$P, Q, R, \ldots$	n-ary first-order predicate (properties, relations)
$\langle s, t\rangle$	p, q, r	$p_0, p_1, \ldots$	proposition, informational intent
$\langle\langle s, t\rangle, t\rangle$	$\mathcal{T}$	$\mathcal{T}_0, \mathcal{T}_1, \ldots$	theme
		$\mathcal{I}$	set of informational intents
$\langle\langle\langle s, t\rangle, t\rangle, t\rangle$		$\mathscr{T}$	set of themes
(varying)	$\mathbb{p}$	$\mathbb{p}_0, \mathbb{p}_1, \ldots$	informational content
(mixed)		$\mathbb{I}$	set of informational contents

Table 2.1

ways of composition with which I assume the reader is familiar. With regard to functional application of unary, first-order predicates, I will use a notation convention, defined in the appendix, to the effect that the following holds:

$$Pj = P(j); \qquad Pjm = (P(j) \wedge P(m)); \qquad \text{and likewise for } Pjmb, \text{ etc.}$$

This shorthand was used already in (4). A fourth way of composing complex expressions in Intensional Logic, and type theory more generally, is functional abstraction. Throughout this dissertation functional abstraction will surface only very incidentally, primarily in the next subsection and in the appendix, so I will give only a brief illustration. The following expression is the result of functional abstraction over the variable x:

$$\lambda x(Px \wedge Qx)$$

This expression denotes, in any given world, a function from individuals to truth values. More precisely, it denotes the unique function that returns true for a given individual if and only if assigning that individual to the variable x makes the expression $(Px \wedge Qx)$ true. Note that we can conceive of this function as a set: the set of all individuals that have both properties denoted by P and Q.

Intensional operators Intensional Logic has the expressive power of two-sorted type theory, a higher-order logic that allows for quantification and abstraction over both individuals and worlds (Gallin, 1975; Zimmermann, 1989). The main difference is that Intensional Logic hides most of the necessary machinery in four convenient operators. I will introduce these operators informally, again leaving a definition of their precise syntax and semantics to appendix A.

The operators $\Box$ and $\Diamond$ are well-known from modal logic, signifying universal and existential quantification over worlds. As in epistemic/doxastic modal logic (but unlike Montague 1973), these operators are taken to quantify not over all logically possible worlds, but the worlds that the speaker thinks may be the actual world. In this way, $\Box$ can be read as "the speaker believes that..." or "the speaker takes herself to know that...", and $\Diamond$ as "the speaker considers it possible that...".

The operators $^\wedge$ and $^\vee$ signify abstraction over and application to worlds. These are used by semanticists and philosophers to switch between *intensions* and *extensions* of concepts, but in this dissertation they will be used almost exclusively to switch between propositions and their truth values. For instance, while Pj denotes true if John is at the party and false otherwise, $^\wedge Pj$ denotes the proposition that John is at the party, namely the set of logically possible worlds in which Pj is true. And where p denotes a proposition, $^\vee p$ denotes the truth value of that proposition in the current world of evaluation. In this limited usage, $^\wedge$ can be read as "(the proposition) that...", and $^\vee$ as "...is true here".

To illustrate, the following formula expresses that the speaker takes herself to know that John is at the party, and that the proposition that John is at the party is an element of the main theme:

$$\Box(P(j) \wedge \mathcal{T}_0(^\wedge P(j)))$$

This may signify that the speaker takes the informational intent that John is at the party to comply with the Gricean maxims of Quality and Relation (see below).

Model-theoretic interpretation Expressions of Intensional Logic are interpreted on a model of some relevant part of the universe. For instance, to interpret the formal expressions in (4), the model must include at least the individuals John, Mary and Bob. More generally, *(pointed) models* are defined as follows:

2.3. Definition. **(Pointed) model**:
A tuple $\mathbf{M} = \langle D, W, R_s, R_a, I\rangle$ is a *model* for Intensional Logic if and only if:

a. D is a domain of individuals;

b. W is a set of logically possible worlds;

c. R_s and R_a are relations on W that model the epistemic states of the speaker and the addressee, respectively;

d. I is an interpretation function that, for each world in W, assigns to each atomic expression an object of the right type (i.e., to expressions of type e an individual, to expressions of type $\langle s, t\rangle$ a proposition, etc.).

A tuple $\langle \mathbf{M}, w_0 \rangle$ is a *(pointed) model* if and only if $\mathbf{M} = \langle D, W, R_s, R_a, I \rangle$ is a model and $w_0 \in W$ models the actual world.

I will briefly discuss the function I and the relations R_a and R_s, before explaining, in the next subsection, how models will be used in this dissertation.

The interpretation function I assigns meanings or intensions to the atomic expressions in the language, i.e., constants and variables. Applying an intension to a particular world of evaluation returns the denotation or extension of the expression in that world. Extensions (and indirectly intensions) of possibly complex expressions are computed recursively by a different function, namely $[\![.]\!]$, defined, on top of I, in appendix A. That is, the extension of an expression α, given a model $\mathbf{M}$, in a particular world w and relative to a particular assignment function g, is given by $[\![\alpha]\!]_{\mathbf{M},w,g}$. For instance, the extension $[\![P(j)]\!]_{\mathbf{M},w,g}$ (a truth value) is obtained by applying the extension $[\![P]\!]_{\mathbf{M},w,g}$ (a function from individuals to truth values) to the extension $[\![j]\!]_{\mathbf{M},w,g}$ (an individual). For expressions φ of type t one may write $\mathbf{M}, w, g \models \varphi$ to mean that $[\![\varphi]\!]_{\mathbf{M},w,g} = 1$. If this holds for arbitrary world and/or assignment function one may also omit these parameters, writing, for instance, $\mathbf{M}, w \models \varphi$ or $\mathbf{M} \models \varphi$. The latter holds if and only if φ is *valid* in the model, i.e., true everywhere in the model.

Accessibility relations like R_s and R_a were not used in Montague 1973, but are commonly used in modal logic for modeling epistemic states (or doxastic states, etc.). A world w' is R-accessible from another world w, if in w the agent considers it possible that w' is the actual world, given their knowledge and beliefs. To illustrate, in terms of the relation R_s, the definition for the modal operators of the speaker read as follows (see the appendix for a more formal definition). For any expression φ of type t, for any given world w:

- $\Box\varphi$ ("the speaker { believes / takes herself to know } that φ") is true in w if, and only if, in all worlds R_s-accessible from w, φ is true.

- $\Diamond\varphi$ ("the speaker considers it possible that φ") is true if, and only if, in some world R_s-accessible from w, φ is true.

We could in principle introduce operators, say, $\diamondsuit$ and $\boxdot$, for the epistemic state of an addressee, which could be interpreted analogously in terms of the relation R_a – but these will not be necessary. Rather, I will occasionally rely on the notion of *common knowledge* ("everybody knows that everybody knows that..."), captured by the operators $\boxplus$ and $\diamondsuit$, interpretations of which are defined in terms of the two relations R_s and R_a (see appendix A).

3.2 Normal, pragmatic utterance models

Pragmatic models

As announced, the formal, rheme-pragmatic part of the theory will consist of a number of maxims, i.e., constraints on the relations between themes, beliefs, intents and contents. The maxims will be formalized by restricting our attention to a subclass of models that interprets a designated set of constants in a particular way, much like *meaning postulates* in Montague's approach. For instance, we can define a *Maxim of Relation* for informational intents by adding a constant I-Relation (the prefix "I" signifying that it governs informational intents) to the formal language and restricting our attention to models that validate the following equivalence (for arbitrary constants or variables p and $\mathcal{T}$ of the right types):

$$\text{I-Relation}(p, \mathcal{T}) = \mathcal{T}(p) \qquad \text{(equivalently: } p \in \mathcal{T})$$

What this says is that an informational intent complies with the maxim of Relation relative to a theme simply if it is contained in the theme. Other maxims can be defined in a similar way (and some of them will be slightly less trivial), by adding constants to the language and restricting our attention to models that interpret it in a particular way.

I will call the relevant class of models *pragmatic models*:

2.4. Definition. **Pragmatic model:** A model $\mathbf{M}$ (or $\langle \mathbf{M}, w_0 \rangle$) is a *pragmatic model* if and only if the model validates (makes true in all its worlds) the definitions of the maxims:

(i) the I-maxims, to be given below;

(ii) the A-maxims, to be presented in chapter 3;

(iii) the maxim of Manner, to be presented in chapter 4.

The question of whether an utterance complies with the maxims then amounts to whether the maxim constants return true in all pragmatic models when applied to the relevant intents and themes, and given the beliefs and goals of the speaker. Conversely, if we assume compliance with the maxims, and restrict our attention accordingly to those pragmatic models in which this is the case, we may be able to draw conclusions about the beliefs and goals of the speaker, and predict interesting implications like exhaustivity.

Normal models

In most of this dissertation, our attention will be further restricted to situations in which a number of conditions hold that, I assume, normally characterize a rational speaker. For instance, I assume that speakers are normally capable of reasoning (K), consistent (D), and know what they know (4) and don't know (5):

2.5. Definition. **Belief axioms.** Each for arbitrary sentences φ, ψ:

$\Box(\varphi \to \psi) \to (\Box\varphi \to \Box\psi)$	(K, Kripke axiom)
$\neg\Box\bot$	(D, consistency)
$\Box\varphi \to \Box\Box\varphi$	(4, positive introspection)
$\neg\Box\varphi \to \Box\neg\Box\varphi$	(5, negative introspection)

These are standard axioms for modal logics of belief, called "KD45". To say that these axioms "normally" hold imposes a constraint on the presupposed theory of beliefs, but not a very strong one – I do not assume that the axioms always hold, and the current theory will make predictions even if they don't. I assume only that the axioms hold, to the relevant extent, in the types of conversations that will be relevant in this dissertation.

It will occasionally be useful to consider also the following condition, although I will not normally assume it:

2.6. Definition. For arbitrary φ: $\Box\varphi \to \varphi$ (3, factivity, *optional*)

Factivity would imply that the speaker has only true beliefs, the addition of which to the earlier set of axioms would turn KD45 into the strong knowledge modality called "S5". I will not take this to be normally the case, which means that I intend the theory of conversation to apply also to cases in which a speaker may have false beliefs – as long as she behaves rationally on the basis of them, i.e., in accordance with KD45.

Besides the belief axioms, I assume that the speaker normally knows what the contents of her utterance are. I also assume that the speaker normally knows what the intents are. I *won't* normally assume the same for themes – a speaker may not know exactly what the goals are. But let us define all three:

2.7. Definition.

- Semantic competence (S):

  $\lambda\mathbb{X}\Box(\mathbb{X} = \mathbb{I})(\mathbb{I})$; and
  for all informational content constants $\mathbb{p}_i$: $\lambda\mathbb{p}\Box(\mathbb{p} = \mathbb{p}_i)(\mathbb{p}_i)$

- Intent introspection (I):

  $\lambda\mathcal{X}\Box(\mathcal{X} = \mathcal{I})(\mathcal{I})$; and
  for all informational intent constants $\mathcal{p}_i$: $\lambda\mathcal{p}\Box(\mathcal{p} = \mathcal{p}_i)(\mathcal{p}_i)$

- Thematic competence (T, *optional*):

  $\lambda\mathscr{X}\Box(\mathscr{X} = \mathscr{T})(\mathscr{T})$; and
  for all theme constants $\mathcal{T}_i$: $\lambda\mathcal{T}\Box(\mathcal{T} = \mathcal{T}_i)(\mathcal{T}_i)$

(In subsequent chapters, conditions S and I must be understood to contain analogous clauses for *attentional* contents and intents.)

I will briefly clarify the effect of lambda-abstraction and subsequent application in each of these conditions – this is one of only a handful of cases in this dissertation in which the lambda makes an appearance at all. Consider, for instance, the second condition, intent introspection. There are two occurrences of the constant $\mathcal{I}$, which denotes the set of informational intents of an utterance. The first lies within the scope of the modal operator $\Box$, hence it signifies, effectively, what the informational intents are *according to the speaker*. The second occurrence lies outside the scope, hence it signifies what the informational intents really are (at least in the world of evaluation). Abstraction and subsequent application bring these two together, equating what the intents really are with what they are believed to be.

Thematic competence is reminiscent of "goal introspection" in, e.g., Dunin-Kęplicz and Verbrugge 2002, and a similar assumption is made in Ciardelli and Roelofsen 2015b about the questions entertained by an agent. Although this type of introspection may be defensible for the speaker's own, primary goals (though cf. chapter 12), I assume that it need not apply to conversational goals in general. After all, it may not always be clear what exactly the other speaker is asking. One might be tempted to exclude such situations as irrelevant cases of miscommunication, but uncertainty about the theme will play a prominent role in part II, on intonational meaning.

With the belief axioms and the conditions on contents, intents and themes in place, a *normal model* is defined as follows:

2.8. Definition. **Normal model:**
A model $\mathbf{M}$ (or $\langle \mathbf{M}, w_0 \rangle$) is *normal* if and only if it validates (makes true in all its worlds) conditions K, D, 4, 5, S, and I – but not necessarily 3 or T – as defined above.

Throughout this dissertation, we will be occupied primarily with models that are both normal and pragmatic (as defined earlier), i.e., that validate both the normality conditions and the definitions of the maxims.

Utterance models

To explore the predictions of the theory with regard to a particular example, we must restrict our attention further, to only those normal, pragmatic models in which the contents, intents and/or themes are precisely as assumed for that example. To illustrate, consider again (4), repeated here:

(4) B: John and Mary are at the party.

$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb, ^\wedge Pjm, ^\wedge Pjb, ^\wedge Pmb, ^\wedge Pjmb\}$
$\mathbb{p}_0 = ^\wedge Pjm$
$\boldsymbol{p}_0 = ^\wedge Pjm$

The relevant normal pragmatic models are such that each of the formulas given in the example is true in the actual world w_0 of that model. Moreover, these models must do some bookkeeping to ensure that the constant $\mathbb{I}$ denotes the set containing all the informational contents mentioned in the example, and likewise for the sets of all informational intents ($\mathcal{I}$) and all themes ($\mathscr{T}$). Lastly, the relevant models must be sufficiently large, i.e., contain sufficiently many worlds, to distinguish all classically non-equivalent first-order formulas that can be constructed using the constants in the example (in this case P, j, m and b). I will call such models "utterance models", defined as follows:

2.9. Definition. **Utterance model:**
A pointed model $\langle \mathbf{M}, w_0 \rangle$ where $\mathbf{M} = \langle D, W, R_s, R_a, I \rangle$ is an *utterance model* for a given example if, and only if:

1. the actual world w_0 validates all formal statements given in the example (in the gray box); and
2. the actual world w_0 validates, for all constants $\mathcal{T}_i$, $\boldsymbol{p}_i$ and $\mathbb{p}_i$ given in the example:

   $$\mathscr{T}(\mathcal{T}_i),\ \mathcal{I}(\boldsymbol{p}_i),\ \text{and}\ \mathbb{I}(\mathbb{p}_i).$$

3. every contingent first-order formula, that can be constructed from only constants used in the example, variables, connectives and quantifiers, is true in some $w \in W$.

(In subsequent chapters, item 2. must be understood to include analogous clauses for attentional intents and contents.)

Note that an utterance model is constrained primarily with regard to its actual world w_0, whereas pragmatic models and normal models were constrained globally. Note, furthermore, that an utterance model permits the existence of contents,

intents and themes not mentioned in the example. (A notion of *closed utterance model* could be defined to exclude that possibility, but this will not be necessary.)

Utterance models, and in particular *normal, pragmatic utterance models*, enable us to instantly formalize the relevant parts of a given example and prove things about it. For instance, assuming the definition of the maxim of Relation given above (the constant I-Relation), we can prove that the intent of (4) complies with the maxim of Relation relative to the given theme:

2.10. Fact. PROOF IN APPENDIX
For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (4):

$$\mathbf{M}, w_0 \models \text{I-Relation}(p_0, \mathcal{T}_0)$$

(Where $\mathbf{M}, w_0 \models \varphi$ means that φ is true in the (actual) world w_0 of the model $\mathbf{M}$; see the appendix.) Moreover, if we look only at those models $\mathbf{M}$ that, in addition, validate thematic competence (condition T above), then we can prove that the speaker will also know this:

$$\mathbf{M}, w_0 \models \Box\, \text{I-Relation}(p_0, \mathcal{T}_0)$$

More interesting things can be proven once more maxims are defined. Throughout this dissertation I will frame formally provable consequences of the theory as "facts" and, for particularly central results, "theorems"; informally derived results may be framed as "predictions". For many facts and theorems proofs are given in appendix B – if so, then this is indicated in the fact/theorem itself.

3.3 Maxims governing informational intents

The formal framework is now in place, with the exception of a small enrichment in part II (the addition of a simple *dynamic* logic). The rheme-pragmatic theory of Attentional Pragmatics, to be defined within this framework, will consist of a number of constraints, i.e., maxims. For concreteness, I will already define the maxims that constrain the rational use of informational intents. These *I(nformation)-maxims* determine which informational intents are rational, given the themes of the utterance and the speaker's beliefs. They will follow Grice's (1989, ch.2) recipe quite closely, i.e., there will be maxims of Quality, Relation, Quantity and (one aspect of) Manner.

As I explained above, the maxims are defined by introducing a number of constants into the language and fixing their interpretation in the relevant subclass of models, the *pragmatic models*. The constants for the I-maxims are I-Quality, I-Relation, I-Quantity and I-Clarity, as well as a convenient wrapper, I-Maxims. With regard to these constants, pragmatic models must satisfy the following definition:

2.11. Definition. Let *compliance* with the various I-Maxims, of an informational intent relative to a theme, be defined according to the following schemata, in which both p and $\mathcal{T}$ are to be substituted by (any) constants and variables of the right type:

1. **I-Quality**: Intend to share only information you take to be true.

$$\text{I-Quality}(p) = \Box^{\vee} p$$

2. **I-Relation**: Intend to share only information that is thematic.

$$\text{I-Relation}(p, \mathcal{T}) = \mathcal{T}(p)$$

3. **I-Quantity**: Intend to share all thematic info you take to be true.

$$\text{I-Quantity}(p, \mathcal{T}) = \forall q \left(\begin{pmatrix} \text{I-Quality}(q) \wedge \\ \text{I-Relation}(q, \mathcal{T}) \end{pmatrix} \rightarrow (p \subseteq q) \right)$$

4. **I-Clarity**: Make sure the intent is understood.

$$\text{I-Clarity}(p) = \lambda \chi \, \boxdot (\chi \in \mathcal{I}) \; (p)$$

2.12. Definition. Let *compliance with all I-Maxims* be defined according to the following schema:

$$\text{I-Maxims}(p, \mathcal{T}) = \begin{pmatrix} \text{I-Quality}(p) \wedge \\ \text{I-Relation}(p, \mathcal{T}) \wedge \\ \text{I-Quantity}(p, \mathcal{T}) \wedge \\ \text{I-Clarity}(p) \end{pmatrix}$$

I will briefly discuss each of the maxims.

I-Quality In the literature, the Gricean (1989, ch.2) maxim of Quality is sometimes phrased in the above, speaker-relative manner, and sometimes more absolutely as "say only that which *is* true", which could be obtained by removing the modal box. The consequences of the present choice for a speaker-relative maxim of I-Quality will matter only in Part II on intonational meaning, where it is shown to determine the ways in which the maxims may clash.

I-Relation The definition of I-Relation was already given earlier, as an example. It may intuitively seem too strict, in various ways:

- it does not allow for what would intuitively constitute *indirect answers*, say, intents that are not themselves part of the theme, but that together with contextual knowledge entail a proposition that is (unlike the notion of Relevance in Roberts 2012);
- it does not allow for intents that merely shift or even raise the probability of a thematic proposition (unlike a similar notion in Büring 2003, p.5);
- it does not allow for unions (unlike Groenendijk and Stokhof 1984; Roberts 2012), intersections, or complements of thematic propositions, unless these happen to be thematic themselves.

The strictness of I-Relation means that some of the flexibility found in other approaches will in the current framework have to be relegated to theme-pragmatics. A number of reasons for this particular division of labor will be discussed in subsequent chapters: it overcomes a redundancy in existing approaches (chapter 4), it sheds light on the symmetry problem (chapter 5), and the division of labor will turn out to closely match certain empirically relevant distinctions (part II).

I-Quantity Grice (1989, ch.2) distinguished a maxim of Relation ("be relevant") from a maxim of Quantity 2 ("don't give more information than necessary"). However, following Grice's own suggestion, I assume that these requirements coincide: both are captured by I-Relation. That leaves only Grice's Quantity-1 ("give as much information as necessary"), which is here formalized simply as I-Quantity.

The requirement imposed by I-Quantity is conditioned on the other maxims. By filling in what the other maxims require, I-Quantity can be phrased more briefly:

$$\text{I-Quantity}(p, \mathcal{T}) = \forall q((\mathcal{T}(q) \wedge \Box^{\vee} q) \rightarrow (p \subseteq q))$$

That is, every proposition that is thematic and believed to be true must be entailed by the intent. The fact that I-Quantity is conditioned on the other maxims entails that potential clashes with these maxims are to some extent incorporated into I-Quantity itself, following, e.g., Harnish 1976, Gamut 1991 (vol.1), and Horn 1984 (though Horn's definition is circular). Grice, too, incorporated the potential clash with Relation into the maxim of Quantity, although he did not do the same for Quality – not for any principled reason, to my awareness. Here the reason is primarily empirical: in part II the range of logically possible clashes will be linked to empirical reality via intonation.

The maxim of I-Quantity may be quite intuitive for responses to so-called "mention-all" questions like (5a), where the responder is indeed expected to share all thematic information that she takes to be true; but it may be less intuitive for so-called "mention-some"-questions like (5b), say, when asked by a tourist, in response to which just a single location will suffice:

(5) a. Of John, Mary and Bill, who was at the party?

b. Where do they sell Italian newspapers in Amsterdam?

(As Groenendijk and Stokhof (1984, p.458) note, (5b) of course also permits a "mention-all" interpretation, for instance if the questioner is not a tourist but someone who is setting up a distribution network for foreign newspapers in Amsterdam.) Because I-Quantity is essentially a "mention-all" maxim, the difference between (5a) and (5b) must reside in the underlying theme. That is, the theme underlying (5b) must be more restricted than the surface form of the question suggests, in a way that could perhaps be explicated as follows:

(6) Where, among places that are reasonably nearby, easy (or even easiest) to direct me to, and that come to mind quickly (or even the quickest), do they sell Italian newspapers in Amsterdam?

It is commonly noted that domain restrictions on quantifiers can be implicit (a case of Bach's (1994) *conversational impliciture*, see chapter 4), and the situation in (5b), compared to (6), might not be any different. This type of account of "mention-some"-questions is pursued, for instance, in Schulz and Van Rooij 2006. Of course it is incomplete without an explanation of how an addressee, presumably by reasoning about conversation-external goals, may figure out the intended domain restriction, and (therewith) the underlying theme – and this type of explanation is needed regardless of how one tries to predict that interrogative sentences have these two possible uses, e.g., whether by means of an implicit domain restriction or, say, by assuming a semantic ambiguity.

For the purposes of this dissertation no detailed account of "mention-some"-questions is necessary. What matters is that, despite the strict formulation of I-Quantity as a "mention-all" maxim, "mention-some"-questions can in principle be accommodated. Just as in the case of I-Relation, discussed above, a strict rheme-pragmatic maxim of I-Quantity just means that a certain share of the explanatory burden rests on theme-pragmatics. Subsequent chapters will show that this particular division of labor is useful and insightful for the main phenomena of interest.

I-Clarity An intent is clearly communicated, basically, if its existence becomes common ground. This is defined using the same trick of abstraction and application we saw when defining the normality conditions: the lambda-bound variable χ gets its value from outside the modal operator, i.e., the value that p really has in the world of evaluation, and this value is compared to what the set of intents ($\mathcal{I}$) contains in the worlds representing the common knowledge of speaker and hearer.

I-Clarity captures only one part of the Gricean maxim of Manner, namely that part which can be defined at the level of single intents. Grice's conciseness requirement is more global, because a word that is unnecessary for conveying one intent may still be necessary for conveying another, and his requirement of

orderliness is similarly global. Some of these global aspects will be captured in a separate maxim of Manner, to be defined in chapter 4.

Utterance compliance

The I-Maxims defined above apply to single intents. We want to be able to say also that an *utterance* complies with the I-maxims, namely if it has an informational intent that does ($\mathcal{I}$ contains all informational intents of the utterance):

2.13. Definition. The utterance complies with the I-maxims relative to the theme denoted by $\mathcal{T}$ if and only if I-Maxims($\mathcal{T}$) is true, defined as:

$$\text{I-Maxims}(\mathcal{T}) = \exists p(\mathcal{I}(p) \wedge \text{I-Maxims}(p, \mathcal{T}))$$

And let compliance with *all* maxims be defined as follows ($\mathscr{T}$ is the set of all themes of the utterance; the A-maxims and Manner remain to be defined):

2.14. Definition. The utterance *complies with all maxims relative to the theme denoted by* $\mathcal{T}$ if and only if Maxims($\mathcal{T}$) is true, defined as:

$$\text{Maxims}(\mathcal{T}) = \begin{pmatrix} \text{Manner} \wedge \\ \text{A-Maxims}(\mathcal{T}) \wedge \\ \text{I-Maxims}(\mathcal{T}) \end{pmatrix}$$

And it *complies with all maxims* (not relative to a theme) if and only if Maxims is true, defined as follows:

$$\text{Maxims} = \forall \mathcal{T}(\mathscr{T}(\mathcal{T}) \rightarrow \text{Maxims}(\mathcal{T}))$$

A pragmatic model must validate all these definitions.

3.4 Some results

For the sake of concreteness and illustration I will present three consequences of the foregoing definitions. The first is an I-Quantity implication, i.e., what is sometimes called a "Quantity implicature" in the literature (e.g., Geurts 2011; cf. chapter 4). Consider again example (4) above, repeated here:

(4) B: John and Mary (are at the party).

$\mathcal{T}_0 = \{\hat{}Pj, \hat{}Pm, \hat{}Pb, \hat{}Pjm, \hat{}Pjb, \hat{}Pmb, \hat{}Pjmb\}$
$\mathbb{p}_0 = \hat{}Pjm$
$p_0 = \hat{}Pjm$

The following can be proven:

2.15. Fact. PROOF IN APPENDIX
For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (4):

$$\mathbf{M}, w_0 \models \text{I-Quantity}(p_0, \mathcal{T}_0) \rightarrow \neg\Box Pb$$

Hence, the rheme-pragmatic theory up to this point predicts that, if the intent of (4) complies with the maxim of I-Quantity relative to the given theme, B must not have the belief that Bill is at the party ($\neg\Box Pb$). Note that this does not mean that she has the belief that Bill wasn't there ($\Box\neg Pb$), i.e., the predicted implication falls short of the purported exhaustivity implication, a matter that will be discussed in detail in chapter 3.

The second result is more general: a speaker will always know whether a given intent complies with the maxim of I-Quality, and likewise for I-Relation and I-Quantity if thematic competence holds:

2.16. Fact. PROOF IN APPENDIX
For all normal pragmatic models $\mathbf{M}$ and any constant p_i:

$$\mathbf{M} \models \Box\,\text{I-Quality}(p_i) \leftrightarrow \text{I-Quality}(p_i)$$

And if thematic competence holds, for any constant $\mathcal{T}_j$:

$$\mathbf{M} \models \Box\,\text{I-Relation}(p_i, \mathcal{T}_j) \leftrightarrow \text{I-Relation}(p_i, \mathcal{T}_j)$$
$$\mathbf{M} \models \Box\,\text{I-Quantity}(p_i, \mathcal{T}_j) \leftrightarrow \text{I-Quantity}(p_i, \mathcal{T}_j)$$

I will occasionally refer to these results as *compliance introspection*. The same cannot be proven for I-Clarity: if a speaker takes something to be common ground, it does not follow that it is.

The third result is also general: if there exists an intent that complies or is taken to comply with all the I-maxims, then it is the only one for which this is the case:

2.17. Fact. PROOF IN APPENDIX
For any normal pragmatic model $\mathbf{M}$ and theme constant $\mathcal{T}_i$:

$$\mathbf{M} \models \forall p \forall q \left(\left(\begin{array}{c} \Box\,\text{I-Maxims}(p, \mathcal{T}_i) \wedge \\ \Box\,\text{I-Maxims}(q, \mathcal{T}_i) \end{array} \right) \rightarrow (p = q) \right)$$

And this holds also without the modal boxes ($\Box$).

This is because, if two intents comply with all I-maxims, and specifically with I-Relation and I-Quality, then compliance with I-Quantity demands that each intent is contained in the other, i.e., that the two are equivalent. (For a more precise proof see appendix B.)

Fact 2.17 shows that at least the informational part of the rheme-pragmatic theory is to a considerable extent *deterministic*: given a certain theme and the speaker's beliefs, we can predict which intent she will be using – at least if there is a compliant intent at all. Moreover, because for each non-contradictory intent there exists a normal pragmatic model in which it complies with the maxims, fact 2.17 implies that for all non-contradictory intents there exists a model in which it is the *unique* compliant intent. This shows that the I-maxims distinguish all type-theoretically (or set-theoretically) distinct informational intents, hence that the mathematical objects by means of which we model informational intents are no richer than necessary for the given characterization of their rational usage. This result is comparable in status to the *antisymmetry* of an order like entailment or meaning inclusion (see Roelofsen 2013b for a recent linguistic perspective).

3.5 Rationality vs. the maxims

Grice (1989, ch.2) already proposed that simultaneous compliance with all of the maxims may not always be possible, i.e., that the maxims may *clash*. Indeed, the same holds for the I-maxims as defined above; an overview of the range of possible clashes will be given in part II. It follows that a maxim-based definition of rationality is incomplete without some account of how speakers optimize their behavior in light of these constraints, i.e., how they *maximize expected compliance*, in some sense (e.g., Sperber and Wilson, 1986b; Davis, 1998).

For current purposes it will not be necessary to formalize the required optimization procedure; but I will make a small number of tentative assumptions in this direction, which may serve as desiderata on a future, more precise account. I will briefly list these assumptions here; some of these will be made a bit more precise in subsequent chapters, when relevant. For present purposes these assumptions about the relation between the maxims and rationality will suffice. They seem to me quite uncontroversial, but they do entail that it will not be sufficient, for a future formalization, to simply add a probabilistic layer to the current formalism (e.g., the modal probability logic of Fagin and Halpern 1988).

First, a rational speaker will, other things being equal, generally prefer improbable violations over probable violations. For instance, if a speaker is unable to comply with certainty with I-Relation because she is uncertain about the nature of the theme she is addressing, she will prefer to address the more likely rather than the less likely instantiation of the theme. And similarly if a clash forces the speaker to choose between, say, a probable I-Relation violation and an improbable I-Quantity violation: the latter will be preferred.

Second, some maxims may be more important than others, so that in case of a clash a rational speaker will generally prefer to violate or risk violating only the less important maxim. Grice already noted that not all maxims are equally important, e.g., that I-Quality is more important than I-Quantity or I-Relation. In part II (chapter 9) I will rely on the importance of I-Quality to account for the

bias expressed by certain uses of a rising intonation contour (rising declaratives, or "declarative questions").

Third, although the foregoing considerations presuppose that expected compliance is to some extent maximized for each maxim individually, perhaps a case can be made for an additional, more global criterion. That is, perhaps speakers consider only utterances that can in principle comply with all the maxims at once, e.g., utterances that could have complied with the maxims if the speaker had been more informed. In chapter 6 I will assume that this is the case, in order to tentatively extend a central result of that chapter to situations in which the maxims are not complied with.

Fourth, the cost of certain actual or potential maxim violations may depend not only on the probability of the corresponding maxim constant being false, but also on some non-probabilistic degree of compliance. For instance, the badness of an I-Quantity violation is presumably proportional to the degree of under-informativeness, and the badness of an I-Quality violation is presumably proportional to the likelihood of the intent being true. (Note that the likelihood of complying with I-Quality is always 0 or 1, given compliance introspection; one might try to change this by removing the modal box from I-Quality, but that would indirectly change also I-Quantity in a non-trivial and empirically impractical way; see part II.)

4 Theme-pragmatics

4.1 Thematic continuity

The theme-pragmatic part of the theory consists of a number of constraints on the speaker's goals and their organization into themes. Unlike the rheme-pragmatic maxims, the theme-pragmatic principles will be informal – a fully formalized theme-pragmatics lies beyond the scope of this dissertation. Fortunately a formal rheme-pragmatics does not require an equally formal theme-pragmatics for it to yield precise predictions. The reason is that at least for an analysis of simple initiative-response pairs we can rely on the following principle:

2.18. Assumption. **Continuity Principle:**
Other things being equal, the goals and thematic organization do not change from one speaker to the next (i.e., the next speaker will adopt those of the previous speaker).

For instance, recall that B's utterance in (4) was taken from (3), where it was preceded by an explicit question by A. We can rely on the Continuity Principle to predict (other things being equal) that the theme of B's response will be the same as the theme of A's question; so we can apply the formal rheme-pragmatic theory

to A's question in order to determine what the theme underlying B's response must have been. By concentrating on explicit initiative-response pairs and relying on the Continuity Principle, theme-pragmatic complexities can often be avoided and most of the explanatory burden will be placed on the formal, rheme-pragmatic part of the theory.

Of course, we need to be somewhat aware of which "other things" may have to be "equal" for the Continuity Principle to apply. A thematic discontinuity may be caused, for instance, by the sudden appearance of a poisonous snake. But there is also a range of more conversation-internal circumstances that could compromise thematic continuity. For instance, a goal will disappear once it is achieved or revealed to be unachievable, i.e., once it is no longer a *reasonable* goal. This is captured by the following principle:

2.19. Assumption. **Reasonable Goal Principle:**
Goals must be potentially accomplishable, i.e., the information can potentially be made common ground, and non-trivial, i.e., the information is not yet common ground.

Roberts captures this in her definition of "QUD" (2012, p.14), and the first half recurs in her "Pragmatics of Questions" (p.22). The same idea occurs also in Cohen and Levesque's (1990) formal theory of goals (their "realism" constraint, p.227, and their definition of "achievement goal", p.233).

Below I assume five more principles that, like the Reasonable Goal Principle, may compromise continuity. These will cover a range of discontinuities that is sufficient for the purposes of this dissertation, but certainly not exhaustive. In practice, this open-ended range of possible exceptions to the Continuity Principle will rarely be problematic, because the rheme-pragmatic part of the theory is so precise that it will often warn us of potential discontinuities. To see how, consider the following rather obvious example:

(7) A: Who is at the party?
B: I like turtles.

Rheme-pragmatics will tell us that B's utterance cannot rationally address the same theme as A's question, except in very specific circumstances, e.g., if there is common knowledge to the effect that B's liking turtles has some bearing on who is at the party *and* there is a reason for B to not give a more direct answer (see chapters 4 and 11). Such special circumstances are certainly worth investigating, and perhaps they obtain in (7), but it could also be an indication of a thematic discontinuity: B may have misheard A's question, or perhaps she suddenly remembered a question from earlier in the conversation. Because rheme-pragmatics is sufficiently precise to warn us of potential theme-pragmatic discontinuities, they can be largely avoided if our aim is merely to evaluate the predictions of the rheme-pragmatic part.

An interesting consequence of the Reasonable Goal Principle is that themes cannot in general be closed under intersection, as is sometimes assumed for theme-like or relevance-like notions in the literature (e.g., Spector 2007). After all, two propositions may each be worth sharing even if their intersection is (commonly) known to be false and hence cannot be a reasonable goal. Still, I will assume closure under intersection *as far as the Reasonable Goal Principle permits*:

2.20. Assumption. **Reasonable Closure Principle** Themes are normally closed under intersection as far as the Reasonable Goal Principle permits, i.e., as far as these intersections can potentially be made common ground.

Closure of themes under (potentially accomplishable) intersections will play a role primarily in an account of exclusivity implications of disjunctive questions (chapter 12); more generally, closure under intersection will be a convenient property in some of the formal results and proofs.

4.2 Some principles that may compromise continuity

In some cases we will be interested precisely in situations where the Continuity Principle is compromised, and for those situations we will need a number of theme-pragmatic principles – five, to be precise. For reasons of transparency I will present them here, although most will not be seen and properly motivated until much later in this dissertation.

The following is closely related to the Reasonable Goal Principle:

2.21. Assumption. **Pruning Principle:**
For any piece of information p worth sharing, the information $\overline{p}$ is also worth sharing (though with lower precedence, unless it was already worth sharing in its own right).

The motivation for this principle is that pruning the set of goals in this manner keeps the conversation focused on those goals that are still achievable, hence information that excludes a certain goal is worth sharing even if it is not primarily relevant in itself. I assume that keeping the set of goals tidy is generally less important than actually achieving those goals, which is captured by the fact that new goals evoked by the Pruning Principle are assigned lower *precedence*, a measure that will remain informal but which is intended to incorporate factors such as importance, priority and centrality. This will play a role in chapter 4, where the Pruning Principle will be invoked to explain why exhaustivity implications may be accompanied by a special type of intent known as *implicature*. The Pruning Principle will also be relied upon in part II, to account for negative responses to positive questions with falling intonation. The Pruning Principle may be a bit simplistic, e.g., another way of pruning the set of goals may be to indicate

dependencies between goals, but the above principle will be sufficient for current purposes.

The next principle, also one of maintenance, helps ensure that no information will appear to enter the common ground that is not in fact common knowledge:

2.22. Assumption. **Common Ground Maintenance Principle**:
An utterance that implies $\Box\varphi$ evokes as conversational goals for the next speaker, the Reasonable Goal Principle permitting, that φ and $\neg\varphi$ be made common ground. These new goals generally have non-maximal precedence, though proportional to (i) the prior desirability of agreeing on φ (e.g., high if making it common ground was already a goal to begin with), and (ii) the unexpectedness of (dis)agreement.

This is reminiscent of the principle "maintain the common ground!" in Groenendijk and Roelofsen 2009, but more general: the current principle applies to *any* implied belief $\Box\varphi$, e.g., that the informational intents of the utterance are true, that they are thematic, that certain words in the sentence were properly pronounced, and so on (for an even more general take: Roberts (2015) models also the alignment of mere expectations, i.e., probability distributions). The principle states that the precedence of these maintenance goals is non-maximal, the idea being that common ground maintenance is primarily a conversation-internal affair, a kind of bookkeeping that serves conversation-external goals only indirectly. If, as seems plausible, goals with precedence below a certain threshold may simply be ignored, and if agreement is often more expected than disagreement, then item (ii) of the principle implies that agreement can often be implicit (as assumed also by Groenendijk and Roelofsen) – but the details of this will not really play a role in this dissertation. The Common Ground Maintenance Principle will be invoked primarily in part II, in particular in chapter 11 on rise-fall-rise intonation.

Another principle that may compromise continuity is the following:

2.23. Assumption. **Strategy Principle:**
If the speaker considers it unlikely that a goal g can be directly achieved (by any of the interlocutors), a new goal g' may be evoked (normally with lower precedence than g) that is sufficiently likely to be part of a strategy for g that is optimal with regard to, e.g., success likelihood, transparency, orderliness, and efficiency.

The lower precedence of the strategic goal, compared to the end goal, is intended to reflect that strategies are only second-best, and to ensure that the original goal remains in place until the strategy succeeds. The empirical relevance of this will become clear in part II, primarily chapter 11, where I will also define a simple notion of strategy. The role of strategies in conversation is highlighted for instance

by Roberts (2012), but her notion of strategy is slightly broader: it covers both *information-seeking* strategies of the sort covered by the Strategy Principle, and *presentational strategies*, to be discussed next.

None of the foregoing principles makes reference to the notion of theme; they apply to individual goals. As such, they arguably belong with a theory of goals proper, rather than with theme-pragmatics in a more narrow sense. Indeed, the only principle that makes reference to themes at all is the following:

2.24. Assumption. **Thematic Organization Principle:**
Goals are organized, and can be reorganized, into themes in a way that optimizes the clarity, efficiency and general smoothness of the (sequence of) utterance(s) by which these goals will be pursued and/or resolved.

For instance, speakers may prefer to evoke themes that an addressee will likely be able to address in compliance with the rheme-pragmatic maxims, and/or that maximize thematic continuity in subsequent dialogue moves – this will be incidentally relied upon in part II. Another example: when asked the complex question "who ate what?" a rational speaker may for reasons of clarity choose to divide the underlying theme into various sub-themes and address them one at a time, e.g., first what John ate, then what Fred ate (the beans, of course), then what Mary ate, and so on. This type of thematic reorganization could be considered a presentational (or cosmetic) type of conversational strategy, as opposed to information-seeking strategies of the sort covered by the Strategy Principle. As I mentioned, the notion of strategy in Roberts 2012 and Büring 2003 covers both types. Presentational strategies, i.e., thematic reorganization, will play a central role on several occasions, foremost in chapter 5 on the symmetry problem.

Lastly, certain goals can be evoked for rheme-pragmatic reasons:

2.25. Assumption. **Clarification Principle**:
If sharing a certain piece of information is necessary for meeting the demands set by the (rheme-pragmatic) maxims of Clarity, this becomes a goal (with non-maximal precedence).

For instance, the Clarity submaxim of the maxim of Manner (chapter 4) will require that the addressee will know whether the utterance was intended to comply with the maxims, and relative to which themes. The Clarification Principle ensures that, in cases where these matters may not be clear from the context, the speaker will provide additional information. This will be relied upon in part II on intonational compliance marking.

The eight theme-pragmatic principles just presented will be sufficient for the purposes of this dissertation. Together they take a considerable burden off of

rheme-pragmatics. For instance, having the Reasonable Goal Principle means that we will not need a rheme-pragmatic maxim to the effect that one should not provide information that is already common ground. Assuming the Pruning Principle and the Common Ground Maintenance Principle means that we can account for negative responses to positive initiatives without building this into I-Relation (and also without assuming that themes are necessarily closed under negation, see chapter 5). And having the Strategy Principle implies that I-Relation need not allow for intents that merely raise the probability of a thematic proposition, because we can account for such utterances by assuming that they address a different, strategic theme. The resulting division of labor between theme-pragmatics and rheme-pragmatics, like the distinction itself, is primarily theory-internal. I hope to show, throughout this dissertation, that the distinction is useful and insightful.

5 Summary and outlook

This chapter presented the conceptual and formal framework of this dissertation, Epistemic Pragmatics. It is speaker-centered, and built around three core auxiliary notions: contents, intents, and themes. Based on these notions the framework was divided into three components: semantics, rheme-pragmatics and theme-pragmatics. I introduced the formalization of rheme-pragmatics in Intensional Logic, and filled in some parts of the framework with pieces of theory, namely four rheme-pragmatic maxims that govern informational intents, and eight theme-pragmatic principles.

In subsequent chapters, the rheme-pragmatic part of the theory, Attentional Pragmatics, will be extended with maxims for attentional intents (chapter 3) and a maxim of Manner (chapter 4). The theme-pragmatic part of the theory will remain limited to the eight principles given above. The semantic part of the theory will remain mostly implicit, except with regard to attentional contents in chapter 6. For a more detailed outline of what lies ahead I refer back to chapter 1.

Chapter 3

Exhaustivity and Attentional Pragmatics

1 Introduction

From B's response in (1), when pronounced with neutral, falling intonation, we may infer that B takes it to be an exhaustive answer to the question – an *exhaustivity implication*:

(1) A: Who (of John, Mary and Bill) is at the party?
B: John is there. *(Mary and Bill aren't, according to B)*

Note that nothing about the mere words "John is there" seems to suggest that Mary and Bill aren't there, unlike explicitly exhaustive answers like "John and no one else" or "only John". The exhaustivity implication can perhaps be explained in terms of speaker rationality: if B had considered it possible that Mary was at the party as well, she would have mentioned it, for instance by uttering (2) instead:

(2) B: John is there, or both John and Mary.

This may sound a bit explicit and artificial, but potentially more natural examples can be constructed that I assume exhibit the same structure as (1)/(2), such as:

(3) a. A: How many kids does John have?
B: Three. / Three or four.
b. A: Did all of the students come?
B: Some of them came. / Some or all of them.
c. A: What will the temperature be like?
B: Warm. / Warm or even hot.

In each case the first response for B may be interpreted exhaustively in a way that the latter may not (though exhaustivity in other respects may be implied by

both variants alike, e.g., in (2) that Bill is not at the party, and in (3a) that John does not have more than four kids).

Intuitively, then, exhaustivity has something to do with mentioning relevant possibilities. The present chapter turns this intuitive account of exhaustivity implications into a precise theory, by introducing the notion of *attentional intent*, i.e., a communicative intention to draw an audience's attention to certain things, to be governed by a new set of rheme-pragmatic maxims. These *A-maxims*, together with the I-maxims defined in chapter 2, constitute most of the rheme-pragmatic theory, Attentional Pragmatics. Earlier versions of the A-maxims appeared in Westera 2013b (not peer-reviewed) and, with more substantial differences, in Westera 2012 and Westera 2014a. This attentional approach to exhaustivity draws inspiration from the accounts of Schulz and Van Rooij (2006) and Alonso-Ovalle (2008), though neither of these provides a satisfactory explanation of exhaustivity, as we will see.

Exhaustivity is a central topic in the field, but no existing account of exhaustivity starts from the intuitive explanation just sketched. The reason is that another intuition has been getting in the way: that exhaustivity would not be about drawing attention to all possibilities, but about providing maximal *information*, e.g., Horn 1972; Gazdar 1979; Schulz and Van Rooij 2006; Spector 2007; Geurts 2011. Basically, existing pragmatic accounts have tried to explain exhaustivity in terms of something like the I-maxims – but that leads to several, mostly well-known problems.

Attention is also a central topic in the field, although it has not to my awareness been explicitly linked to exhaustivity. The current notion of attentional intent draws inspiration primarily from *attentive semantics* by Ciardelli, Groenendijk, and Roelofsen (2009), and more indirectly from work on attention and anaphora, e.g., Kamp 1981; Bittner 2007; Murray 2010. A comparison between the role of attention in the current and existing accounts will be postponed to chapter 6, because it is not straightforward, for instance because the distinction between content and intent is not always clearly maintained.

Outline Section 2 highlights a number of mostly well-known problems for existing accounts. Section 3 introduces the notion of attentional intent and defines the A-maxims in Intensional Logic, as explained in chapter 2. Section 4 then derives exhaustivity implications for various examples and also characterizes the predicted implications more generally, in terms of an exhaustivity "operator", to be used with caution. I will establish certain correspondences between this operator and existing operators in the literature. Section 5 concludes, and outlines which subsequent chapters address the various questions that will be left open by the current chapter.

2 The standard recipe and some problems

2.1 The standard recipe: I-Quantity plus competence

Existing pragmatic accounts of exhaustivity are based on something like the maxim of I-Quantity: that rational speakers intend to share all thematic (or relevant) information they take to be true. To illustrate, suppose that (1B) above has the following theme and informational intent (I will leave its content implicit):

$\mathcal{T}_0 = \{^Pj, ^Pm, ^Pb, ^Pjm, ^Pjb, ^Pmb, ^Pjmb\}$
$p_0 = ^Pj$

Now, from I-Quantity it follows that, since B did not intend to convey that Mary was at the party, she must not have the belief that she was. Indeed, with this theme and intent we can prove the following (in chapter 2 I already illustrated the same, for a very similar example; see fact 2.15):

3.1. Fact. For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (1B) that validate thematic competence:

$$\mathbf{M}, w_0 \models \text{I-Quantity}(p_0, \mathcal{T}_0) \rightarrow \neg\Box Pm$$

And we can conclude something similar for Bill, i.e., $\neg\Box Pb$. This is almost like exhaustivity ($\Box\neg Pb$), but not quite: from the absence of a positive belief we may not in general conclude the presence of a negative belief:

$$\neg\Box Pm \not\Longrightarrow \Box\neg Pm$$

The speaker could simply be ignorant, after all.

That the implication due to something like I-Quantity falls short of accounting for exhaustivity was already pointed out by Soames (1982, p.534), in a discussion of Gazdar's (1979) account. More recently, Sauerland (2004) called the gap between I-Quantity and exhaustivity, i.e., between not believing and believing that not, the "epistemic step". As a solution to the epistemic step, Soames proposed that participants in a conversation normally or in the relevant situations assume each other's *competence* (or, more accurately when talking about beliefs, *opinionatedness*, but I will not try to push a terminological change). Indeed, if we assume for whatever reason that speaker B in (1) knows whether or not Mary is at the party, the I-Quantity implication can be strengthened, yielding exhaustivity:

$$\neg\Box Pm \wedge \overbrace{(\Box Pm \vee \Box\neg Pm)}^{\text{competence assumption}} \Longrightarrow \Box\neg Pm$$

While this reliance on a competence assumption has been criticized by some for being ad hoc (e.g., Groenendijk and Stokhof, 1984; Chierchia, Fox, and Spector,

2012), it is embraced by many following Soames (e.g., Leech 1983; Horn 1984; Matsumoto 1995; Green 1996; Russell 2006; Schulz and Van Rooij 2006; Geurts 2011; Goodman and Stuhlmüller 2013; Horn (2001) notes that the solution can be found already in Mill 1867). For instance, Geurts writes that connecting "weak" implications like $\neg\Box Pm$ to "strong" implications like $\Box\neg Pm$ via the competence assumption is "one of the main virtues" of this approach (p.30).

Existing accounts, based on I-Quantity and a competence assumption, are different from the intuitive explanation of exhaustivity with which this chapter started. The explanation there was that in (1) speaker B must believe that Mary is not at the party, because otherwise B would have mentioned it, i.e., drawn attention to it, by uttering (2) instead. This explanation relies essentially on a maxim that requires that attention be drawn to everything relevant that one considers possible, say, a maxim of *A-Quantity*. Schematically, and only pseudo-formally, I-Quantity and A-Quantity compare as follows:

I-Quantity: $(\text{relevant}(\varphi) \wedge \Box\varphi) \rightarrow \text{assert}(\varphi)$
A-Quantity: $(\text{relevant}(\varphi) \wedge \Diamond\varphi) \rightarrow \text{draw-attention-to}(\varphi)$

Somehow the explanation based on A-Quantity has not been explored or even been noticed in the literature. In the next subsection I will point out a number of known problems for accounts based on I-Quantity, that appear to be straightforwardly resolved or avoided by an account based on A-Quantity. In section 3 this informal maxim of A-Quantity will be turned into a proper theory.

2.2 Some problems for the standard recipe

Granularity

Accounts based on I-Quantity cannot easily distinguish between examples like (1), "John is there", and (2), "John, or both John and Mary". After all, the most straightforward informational intents (and contents) for these utterances would correspond to the classical meanings of their closest translations into predicate logic, Pj and $Pj \vee (Pj \wedge Pm)$ – but these are classically (informationally) equivalent. This problem was noted already by Gazdar (1979), but to my awareness no satisfactory account exists; I will here briefly discuss Gazdar's approach and two more recent approaches (Schulz and Van Rooij 2006 and Alonso-Ovalle 2008). This may be a consequence of the information-centeredness of existing accounts – in attentional terms the relevant difference between (1) and (2) is rather obvious.

Gazdar himself tries to deal with this granularity problem by assuming that utterances have "clausal" implications (or "clausal implicatures", but not in the Gricean sense, cf. chapter 4), to the effect that a speaker should be uncertain about any embedded clause of an uttered sentence, e.g., the disjuncts of a disjunction. The uncertainty thus predicted for "...or both" in (2) would indeed contradict

exhaustivity to the right extent. Setting aside how such contradictions would then have to be resolved, Gazdar's pragmatic explanation for clausal implications is problematic. It relies on the assumption that both embedded clauses and their negations are always relevant, a symmetry that is crucial for deriving the necessary uncertainty about the disjunct "...or both" rather than the mere lack of belief. Unfortunately, assuming this type of symmetry more generally leads to the well-known *symmetry problem* (see chapter 5).

More recent accounts have succeeded at most at describing but not at explaining the contrast between (1) and (2). For instance, Schulz and Van Rooij (2006) describe the contrast by making their "exhaustivity operator" sensitive to the discourse referents that an utterance would introduce – basically, the things to which the utterance would draw attention (cf. chapter 6). But they do not motivate this part of their operator in terms of speaker rationality; the part which they do motivate relies on I-Quantity and the competence assumption. Alonso-Ovalle (2008) likewise defines a fine-grained exhaustivity operator in order to account for (1) and (2), but he too does not offer an explanation. Moreover, his operator does not generalize to more intricate examples like "John has one, three or five kids". I will compare these various "operators" to the current approach in more detail in section 4.3. (The "grammatical" approach, to be discussed very briefly at the end of this section, aims to describe the contrast between (1) and (2) rather differently, namely by applying an exhaustivity operator to each disjunct separately.)

Exhaustivity without I-Quantity

Another potential problem for accounts based on I-Quantity is that exhaustivity implications seem to occur on utterances to which I-Quantity arguably does not even apply. For instance, questions have been observed to imply exhaustivity in some form, at least when pronounced with a falling intonation contour (e.g., Bartels 1999; Roelofsen and Van Gool 2010; Biezma and Rawlins 2012; to be discussed in part II):

(4) A: Was John there, or Mary?
(according to A there was only one, and no one else that's relevant)

Since questions plausibly lack a main informational intent (see chapter 6), it is unclear to which intent I-Quantity could apply for it to yield exhaustivity.

Another case in which I-Quantity does not apply, or at least not genuinely, is a quiz situation (considered also in Grice 1989, ch.3): a quizmaster would not normally be expected to share all the relevant information in their possession. And yet, Fox (2014) argues that exhaustivity implications occur on the hints of a quizmaster (again, depending on intonation):

(5) Quizmaster: There is money in box A or in box B.
(not in both, according to the quizmaster)

But the usual I-Quantity implication, that the quizmaster does not know exactly where the money is, is absent. I refer to Fox for a detailed discussion and criticism of a number of hypothetical ways in which an account based on I-Quantity may still try to cope with hints like this.

Promisingly, the tentative maxim of A-Quantity may well apply to these two cases, i.e., questions and hints. For although questions may indeed lack a main informational intent, they clearly do serve to draw attention to various things. And although quizmasters are not supposed to provide all the information in their possession, they may be found guilty of misleading if they do not mention all possible choices for a quiz participant – or so it seems to me. (An alternative understanding of (5) would involve pretense: a quizmaster would be allowed to pretend only a *lack* of knowledge about where the money is, hence the I-Quantity implication ($\neg\Box$) can be pretense, but exhaustivity ($\Box\neg$) mustn't be – and if this explanation is correct then *any* account of exhaustivity that bypasses I-Quantity can in principle explain why exhaustivity does occur on hints.) In the remainder of this dissertation I will set the quiz scenario aside as an "abnormal" context; but I will return to exhaustivity on questions further below (briefly), and in more detail in part II (chapter 12).

Exhaustivity without a competence assumption

As I mentioned, the purported role of a competence assumption in accounts based on in I-Quantity is embraced by many. The main reason for this is that the exhaustivity implication seems to disappear if the speaker denies her own competence, as Soames (1982) noted:

(6) A: Who's at the party?
B: I'm not sure about the others, but John is there.

Similar examples can be found throughout the literature. Breheny, Ferguson, and Katsos, 2013 present experimental results that seem to support the reliance of exhaustivity implications on a competence assumption also in less explicit cases. They presented participants with utterances that could measurably trigger or not trigger an exhaustivity implication, while manipulating the participant's knowledge about the speaker. When the participants knew that the speaker had only partial knowledge about the topic, the exhaustivity implications were absent; otherwise they were present. Goodman and Stuhlmüller, 2013 present similar results.

However, these experimental results as well as Soames's original observation have arguably been misunderstood. For in the relevant examples, not only is the supposed competence assumption denied; it is in fact replaced by an *incompetence assumption*. And to be incompetent is to be unable to give an exhaustive answer. Hence, it is unsurprising that assuming incompetence has

some effect on exhaustivity, regardless of whether its presence would have depended on a competence assumption to begin with.

A better test case for approaches based on the competence assumption would be to deny not the speaker's competence, but merely the competence *assumption*, and see if exhaustivity appears. The following example is such a test case (this type of example, as criticism against approaches based on the competence assumption, is discussed in Westera 2014a):

(7) A: I *may* be asking the wrong person, but who were at the picnic?
B: John, Bob, Mary, and Sue. *(with falling intonation)*
A: Wow, only four huh. Must have been boring. Well, thanks!

(I will shortly discuss the possible significance of intonation.) In this conversation A explicitly does not assume B's competence, though crucially without assuming her *in*competence, and in the end A still takes B's answer to be exhaustive. I think that this kind of conversation is perfectly conceivable, which would suggest that exhaustivity implications do occur without a competence assumption. To add some force to this empirical claim, appendix C presents the judgments of ten native speakers of Dutch, gathered by means of a simple on-line questionnaire with an auditory stimulus. With regard to an essentially analogous example in Dutch (though slightly more elaborate to control for certain factors), eight of them drew an exhaustivity inference despite the explicit and contextual denial of a competence assumption.

A possible objection to my interpretation of (7) and the questionnaire results is that B's competence may be conveyed intonationally, by means of her falling intonation contour. Indeed, falling intonation tends to sound more decisive/definitive/authoritative than a final rising pitch (e.g., Ohala, 1983). Note that this suggestion (found, e.g., in Hara 2005; Schulz and Van Rooij 2006) takes us quite far from most existing pragmatic accounts of exhaustivity, according to which the competence assumption would come from the context; it brings us close to approaches that attach exhaustivity itself directly to the falling intonation contour, bypassing the competence assumption and I-Quantity altogether (e.g., Zimmermann 2000; Biezma and Rawlins 2012; such accounts will be discussed in part II). Nevertheless, I will briefly discuss this suggestion here, because I think it is quite compelling and, moreover, relevant to the other main topic of this dissertation, i.e., intonational meaning.

Indeed, I think that (7) strongly suggests that competence is not contextually assumed but conveyed by the speaker, and I also assume that intonation is a crucial ingredient. However, the fact that intonation plays a role in exhaustivity and that falling intonation sounds competent does not tell us much about the inferential origins of either competence or exhaustivity, e.g., about which comes first: exhaustivity implies competence, after all. For all we know, final falls and

rises could be used by speakers to indicate (non-)compliance with the maxims, which would still in some way point to the maxims as the real source of exhaustivity. This matter can be decided only within the context of a reasonably general and explanatory theory of intonational meaning, which is in part what motivates part II of this dissertation.

Even if competence would be indicated intonationally, competence plain and simple would not suffice, or one would wrongly predict the same exhaustivity implication for the variant in (2) with "...or both", which would convey competence in one respect and ignorance in another (Schulz and Van Rooij, 2006). That is, regardless of whether competence is a contextual assumption or conveyed intonationally, it must somehow be sensitive to the things mentioned in the utterance – say, the things to which attention is drawn. This calls for an explanation, and to simply assume that the right sort of competence is part of the conventional contribution of a particular intonation contour is to admit defeat (cf. convention minimalism, chapter 1).

Embedded exhaustivity?

It has been claimed that exhaustivity sometimes appears to be embedded under a syntactic/semantic operator, in ways that would suggest that exhaustivity must be part of the semantic contents of those embedded parts of the sentence (e.g., Chierchia, Fox, and Spector, 2012). I will not explicitly discuss such claims in this dissertation, for three main reasons.

First, it is unclear to what extent the reported intuitions and experimental results on embedded exhaustivity reflect a uniform phenomenon at all (Geurts, 2009; Geurts, 2011; Van Tiel, 2014). Van Tiel argues that at least some results can be explained as reflecting *typicality inferences*, which may appear to embed in ways that one would not necessarily expect of implications that are due to a Quantity-like maxim. To this I will just add that, like the notion of typicality inference before Van Tiel pointed it out, the notion of *impliciture* (Bach, 1994) is often overlooked in the discussion of embedded exhaustivity. This notion, to be covered in chapter 4, is driven primarily by considerations of Manner and relation, which could conceivably apply to embedded constituents in ways that a Quantity-like maxim might not.

Second, the argument "seemingly embedded, therefore part of the semantic content" is not valid (Simons, 2011). For one, as Simons notes, pragmatics is not blind to sentence-internal structure: although some of the pragmatic constraints that apply "globally", i.e., to entire utterances, may not apply "locally", i.e., to mere constituents, there may be other pragmatic constraints that do. Moreover, global features of an utterance correlate with the internal structure of the uttered sentence in ways that may give the impression of semantic embeddedness. This is especially clear with regard to the set of things to which attention is drawn by an utterance: this global feature of an utterance may correspond quite directly to the

set of disjuncts of the uttered sentence (see chapter 6). As a consequence, maxims that govern attention-drawing, like A-Quantity, may appear to be more directly sensitive to sub-sentential structure than maxims that govern information-sharing – indeed, as we will see, certain purported cases of embedded exhaustivity will be quite straightforwardly accounted for by A-Quantity (e.g., "John has one, three or five kids").

Third, even if embedded exhaustivity is real, and if it is to be treated as a unified phenomenon together with standard, unembedded exhaustivity, and if this would suggest that exhaustivity is conventionally associated with certain expressions, this would still not render the search for a (globalist) pragmatic explanation for unembedded exhaustivity pointless. Grice (1989, ch.2, p.39) already noted that what is initially pragmatic can conventionalize (cf. chapter 1, section 3.3). Hence, a pragmatic explanation of exhaustivity, should it turn out to be insufficient, may still be necessary as the starting point of an explanation of the purported linguistic conventions surrounding exhaustivity. For this reason, the aims of this dissertation do not presuppose any particular position on the issue of embedded exhaustivity, and I will set this discussion aside.

A remark on the "grammatical" approach I have pointed out a number of problems for accounts based on I-Quantity: granularity, exhaustivity without I-Quantity, exhaustivity without a competence assumption, and, maybe, (some cases of) embedded exhaustivity. Given these problems for accounts based on I-Quantity, and because no other pragmatic accounts have been explored, some scholars have concluded that no pragmatic account of exhaustivity can be given at all. Motivated thus, a very different approach to exhaustivity has been proposed, namely the "grammatical" approach, according to which exhaustivity is contributed to the semantic content by purported syntactic "exhaustivity operators" (e.g., Chierchia, 2004; Fox, 2007; Chierchia, Fox, and Spector, 2012; Katzir and Singh, 2013). To my understanding, most proponents of the grammatical approach nevertheless agree that a pragmatic account would be preferable if available, for reasons of parsimony and explanatory potential (a possible exception is Fox 2014, p.3). For this reason, rather than directly argue against the grammatical approach, I will just show that a pragmatic account of exhaustivity *can* be given, at least one that overcomes the first three problems (and I have explained why I will not discuss the fourth potential problem, i.e., embedded exhaustivity). Moreover, in chapter 5 I will show how another purported problem for pragmatic accounts of exhaustivity can be solved, namely the "symmetry problem", which has likewise been invoked to motivate the grammatical approach. For arguments against the grammatical approach as such, primarily that it may not really solve the problems that motivate it, I refer to Russell 2006 and Geurts 2013.

3 Attentional Pragmatics

3.1 Attentional intents

If exhaustivity implications are indeed to be explained in terms of something like the tentative maxim of A-Quantity mentioned above, then attention-drawing must be a type of communicative intention, that serves a certain conversational goal, and can be constrained by rationality accordingly. As with informational intents (and contents), the precise nature of the notion of attentional intent will be fixed by the theory as a whole, but the relevant rationality constraints will be motivated by conceiving of them in a certain way.

Let an attentional intent be conceived of as a set of (logically) possible *states of affairs* to which the speaker intends to draw the audience's attention. A state of affairs could be, for instance, John's presence at a certain party, or it being rainy. That utterances have attentional intents is, to my awareness, a new assumption to make, so I will make it explicit:

3.2. Assumption. Utterances have *attentional intents*. An attentional intent is a non-empty set of states of affairs to which a speaker intends to draw the audience's attention. (Moreover, sentences may be said to have attentional *contents*, see chapter 6.)

Of course, an utterance may draw attention to various things besides states of affairs – basically to anything that is mentioned in an utterance, in some sense. But I assume that most of those things are unintended side-effects of the attentional intent, i.e., of the speaker's intention to draw attention to certain states of affairs, and that they are irrelevant for a characterization of speaker rationality. This may be a simplification, but, if so, it appears to be a harmless one at least for the phenomena to be considered in this dissertation.

The notions of proposition and state of affairs have a long history in philosophy, but at present no philosophical depth is intended or necessary. I will model both propositions and states of affairs as sets of possible worlds, so the difference is merely terminological. The only reason for saying that attention is drawn to states of affairs rather than propositions (pieces of information) is that this may correspond a bit better to ordinary language (for what it's worth): an utterance would primarily draw attention to, e.g., John's presence, not to the information that John is present. As sets of states of affairs, or formally equivalent sets of propositions, attentional intents are superficially similar to various notions in the literature on questions, disjunctions and indefinites (e.g., Hamblin, 1973; Kratzer and Shimoyama, 2002; Aloni, 2002; Alonso-Ovalle, 2006; Ciardelli, Groenendijk, and Roelofsen, 2013), focus alternatives (e.g., Rooth, 1992), propositional discourse referents (e.g., Murray, 2010; Krifka, 2013) and the attentional effects of "might"-utterances (Ciardelli, Groenendijk, and Roelofsen,

2009; Brumwell, 2009; Bledin and Rawlins, 2016). Moreover, something like attention has been central to much work on anaphora resolution, explicitly or implicitly, at least since Kamp 1981 and Heim 1982. A comparison between some of these strands and notions is not straightforward, and postponed to chapter 6.

As for the role of attentional intents in conversations geared towards information exchange, I assume that it is to highlight states of affairs whose obtaining one would want to see become common ground. Hence, the rationality constraints on attentional intents, the "A-maxims", will be defined relative to the same parameter as the I-maxims: a *theme*. This may again be a simplification; perhaps there can be good reasons for drawing attention to a state of affairs whose obtaining we don't care about. But for the phenomena to be considered such generality will not be necessary.

Incorporating the notion of attentional intent in the formal framework presented in chapter 2 is straightforward. Sets of states of affairs are (like sets of propositions) of type $\langle\langle s,t\rangle,t\rangle$. For individual attentional intents I reserve appropriate variables ($\mathcal{A}$, $\mathcal{B}$, ...) and constants ($\mathcal{A}_0$, $\mathcal{A}_1$, ...). For the set of all attentional intents of the modeled utterance I reserve the constant $\mathscr{A}$. (Recall that utterance models model only a single utterance.) Semantic contents, informational or attentional, will not play a role in this chapter: I will simply assume particular intents for the relevant examples on a case by case basis. I will not motivate the informational intents, but simply presuppose that they could be communicated by the informational contents that a semantic theory could plausibly deliver. The assumed attentional intents will be motivated in detail in chapter 6, in terms of a notion of attentional content.

To illustrate the formalism, consider the minimal pair (1)/(2) with which this chapter started, repeated here as (8) with (some of) the themes and intents I assume:

(8) a. A: Who (of John, Mary and Bill) is at the party?

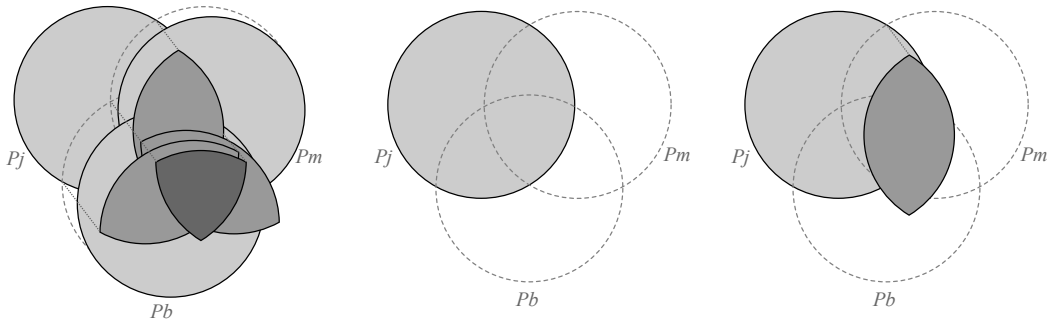
$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb\}^\cap \qquad \mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb\}^\cap$

b. B: John is at the party.

$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb\}^\cap \qquad p_0 = {^\wedge Pj} \qquad \mathcal{A}_0 = \{^\wedge Pj\}$

c. B: John is at the party, or John and Mary.

$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb\}^\cap \qquad p_0 = {^\wedge Pj} \qquad \mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pjm\}$



(a) (b) (c)

Figure 3.1

I am now using $\{...\}^{\cap}$, a notational shorthand for closure under intersection (see appendix A), such that:

$$\{^{\wedge}Pj, ^{\wedge}Pm, ^{\wedge}Pb\}^{\cap} = \{^{\wedge}Pj, ^{\wedge}Pm, ^{\wedge}Pb, ^{\wedge}Pjm, ^{\wedge}Pjb, ^{\wedge}Pmb, ^{\wedge}Pjmb\}$$

The assumed attentional intents for (8a), (8b) and (8c) are depicted, from left to right, in figure 3.1. Each attentional intent is depicted as a Venn diagram on the set of all possible worlds, based on the three atomic states of affairs of John's, Mary's, and Bill's presence (the circles). Overlapping regions are pulled apart in a third dimension, "towards" the reader, for clearer presentation. In each case, the attentional intent is the set containing all shaded regions as elements. Note that the leftmost diagram can also be conceived of as depicting the assumed theme.

I will briefly walk through the formalized assumptions.

- I assume that the theme of A's question and B's responses is the same: the set containing a proposition for each possible combination of individuals attending the party. This will be motivated in section 4, by showing how this theme can, at least for B's responses, be predicted given the attentional intent of A's question.

- The attentional intent of A's question, in turn, will be motivated in chapter 6. I assume that it has no (main) informational intent – it is a question after all – but for present purposes nothing will hinge on this.

- B's responses have identical informational intents, namely the proposition that John is at the party, in line with the aforementioned classical equivalence of Pj and $Pj \vee (Pj \wedge Pm)$.

- B's responses have distinct attentional intents. With (8b), B intends to draw attention only to John's presence, while with (8c) she intends to

draw attention also to John and Mary's joint presence. This may seem uncontroversial, but I will nevertheless motivate it in chapter 6.

For the current chapter, the foregoing assumptions will suffice.

3.2 The A-Maxims

I assume the following *A-maxims*, which govern attentional intents:

3.3. Definition. Let compliance with the various A-Maxims, of an attentional intent relative to a theme, be defined according to the following schemata, in which both $\mathcal{A}$ and $\mathcal{T}$ are to be substituted by constants and variables of the right type:

1. **A-Quality**: Intend to draw attention only to states of affairs that you consider possible.

$$\text{A-Quality}(\mathcal{A}) = \forall a(\mathcal{A}(a) \rightarrow \Diamond^{\vee} a)$$

2. **A-Relation**: Intend to draw attention only to thematic states of affairs.

$$\text{A-Relation}(\mathcal{A}, \mathcal{T}) = \forall a(\mathcal{A}(a) \rightarrow \mathcal{T}(a))$$

3. **A-Parsimony**: Intend to draw attention to a state of affairs only if, if you consider it possible, you consider it possible independently of any more specific thematic state(s) of affairs.

$$\text{A-Parsimony}(\mathcal{A}, \mathcal{T}) = \forall a \left(\begin{array}{c} (\mathcal{A}(a) \wedge \text{A-Quality}(\{a\})) \rightarrow \\ \Diamond \left({}^{\vee} a \wedge \forall b \left(\left(\begin{array}{c} b \subset a \wedge \\ \text{A-Relation}(\{b\}, \mathcal{T}) \end{array} \right) \rightarrow \neg {}^{\vee} b \right) \right) \end{array} \right)$$

4. **A-Quantity**: Intend to draw attention to all thematic states of affairs you consider independently possible.

$$\text{A-Quantity}(\mathcal{A}, \mathcal{T}) = \forall a \left(\left(\begin{array}{c} \text{A-Quality}(\{a\}) \wedge \\ \text{A-Relation}(\{a\}, \mathcal{T}) \wedge \\ \text{A-Parsimony}(\{a\}, \mathcal{T}) \end{array} \right) \rightarrow \mathcal{A}(a) \right)$$

5. **A-Clarity**: Make sure the intent is understood.

$$\text{A-Clarity}(\mathcal{A}) = \lambda \mathcal{X} \, \boxdot(\mathcal{X} \in \mathscr{A})(\mathcal{A})$$

The A-maxims follow the same general recipe as the I-maxims, except for the addition of the maxim of A-Parsimony. I will shortly discuss each in turn, but first introduce the following wrappers, analogous to their informational counterparts:

3.4. Definition. Let compliance of an intent with *all* A-maxims, relative to a theme, be defined as:

$$\text{A-Maxims}(\mathcal{A}, \mathcal{T}) = \begin{pmatrix} \text{A-Quality}(\mathcal{A}) \wedge \\ \text{A-Relation}(\mathcal{A}, \mathcal{T}) \wedge \\ \text{A-Parsimony}(\mathcal{A}, \mathcal{T}) \wedge \\ \text{A-Quantity}(\mathcal{A}, \mathcal{T}) \wedge \\ \text{A-Clarity}(\mathcal{A}) \end{pmatrix}$$

And compliance of an entire *utterance*, with the A-maxims, relative to a theme:

$$\text{A-Maxims}(\mathcal{T}) = \exists \mathcal{A}(\mathscr{A}(\mathcal{A}) \wedge \text{A-Maxims}(\mathcal{A}, \mathcal{T}))$$

(Recall that $\mathscr{A}$ is the set of all attentional intents of an utterance.) All these definitions must be validated by *pragmatic* models, as defined in chapter 2.

A-Quality The maxim of A-Quality is assumed also by Roelofsen ((2013); building on Ciardelli, Groenendijk, and Roelofsen 2009), who calls it "Attentive Sincerity", and at least with regard to the attentional intents of questions (cf. chapter 6) it corresponds to the "Viability" constraint in Biezma and Rawlins 2012 (p.46), and "Genuineness" in Zimmermann 2000 (p.270; he explores a semantic and a pragmatic account). A similar intuition may have underlain Gazdar's "clausal implicatures", mentioned earlier.

A-Relation A-Relation is a straightforward pointwise generalization of I-Relation. Like I-Relation (as discussed in chapter 2), A-Relation may seem overly strict in various ways, the motivation for which will become clearer as this dissertation unfolds.

A-Clarity A-Clarity is entirely analogous to I-Clarity. It captures an aspect of Manner that can be stated at the level of single intents, leaving the rest of Manner for a separate, global maxim.

A-Quantity The maxim of A-Quantity is analogous to I-Quantity, likewise incorporating potential clashes with the other maxims, and likewise embodying a

"mention-all" assumption (and more literally so). By spelling out what some of the other maxims require, A-Quantity can be formulated more succinctly:

$$\text{A-Quantity}(\mathcal{A},\mathcal{T}) = \forall a \left(\left(\begin{array}{c} \mathcal{T}(a) \wedge \Diamond^{\vee} a \wedge \\ \text{A-Parsimony}(\{a\},\mathcal{T}) \end{array} \right) \rightarrow \mathcal{A}(a) \right)$$

If we ignore A-Parsimony, this corresponds to the hypothetical, informal maxim of A-Quantity suggested already in section 2. By contraposing the implication, A-Quantity can be read as follows: if a speaker does not intend to draw attention to a certain thematic state of affairs ($\neg\mathcal{A}(a)$), that means she must not consider it possible ($\neg\Diamond^{\vee} a$), or at least not possible independently of more specific thematic states of affairs (A-Parsimony). The first disjunct corresponds exactly to the intuitive account of exhaustivity with which this chapter started; but the second disjunct is also crucial, as I will explain next.

A-Parsimony Consider a speaker B who believes that if John and Mary are at the party, then so is Bill ($\Box(Pjm \rightarrow Pb)$). Now, consider the following two utterances made by this speaker:

(9) a. B: John is at the party, or John, Mary and Bill.

$\Box(Pjm \rightarrow Pb)$
$\mathcal{T}_0 = \{^{\wedge}Pj, {}^{\wedge}Pm, {}^{\wedge}Pb\}^{\cap}$ $\quad \mathcal{A}_0 = \{^{\wedge}Pj, {}^{\wedge}Pjmb\}$ $\qquad p_0 = {}^{\wedge}Pj$

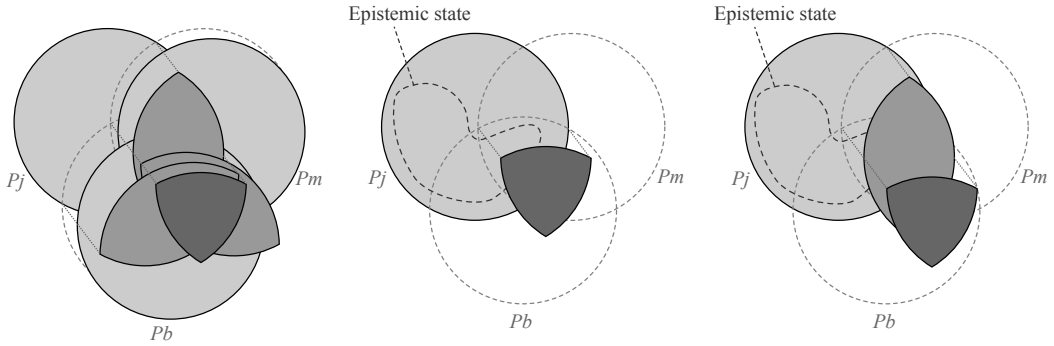
b. (?) B: John is there, or John and Mary, or John, Mary and Bill.

$\Box(Pjm \rightarrow Pb)$
$\mathcal{T}_0 = \{^{\wedge}Pj, {}^{\wedge}Pm, {}^{\wedge}Pb\}^{\cap}$ $\quad \mathcal{A}_0 = \{^{\wedge}Pj, {}^{\wedge}Pjm, {}^{\wedge}Pjmb\}$ $\; p_0 = {}^{\wedge}Pj$

I take it that the utterance in (9b) is intuitively quite strange (strangeness is what I will henceforth indicate by "(?)"): why did B include the middle disjunct – or, in terms of attentional intents, why did B intend to draw attention to John and Mary's joint presence ($^{\wedge}Pjm$)? The maxim of A-Parsimony captures precisely this strangeness: drawing attention to John and Mary's joint presence is not parsimonious, i.e., superfluous, because B does not consider it possible independently of the presence of all three of them ($^{\wedge}Pjmb$). More precisely, it can be derived for (9b) that the attentional intent violates either A-Quality, if $^{\wedge}Pjmb$ is not in fact considered possible, or A-Parsimony, if it is and $^{\wedge}Pjm$ is not possible independently of it:

3.5. Fact. PROOF IN APPENDIX
For all normal pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (9b) that validate thematic competence:

$$\mathbf{M}, w_0 \models \neg\,\text{A-Quality}(\mathcal{A}_0) \vee \neg\,\text{A-Parsimony}(\mathcal{A}_0, \mathcal{T}_0)$$



(a) (b) (c)

Figure 3.2

In contrast, the same result does not obtain for normal pragmatic utterance models for (9a). Indeed, for (9a) there exists a normal pragmatic utterance model in which all the maxims are complied with.

It may be helpful to visualize the effect of A-Parsimony. To this end, the theme and both attentional intents of (9) are depicted in figure 3.2. Relative to the theme in figure 3.2a, and given the indicated epistemic state, the attentional intent in figure 3.2b complies with A-Parsimony, while the attentional intent in figure 3.2c violates it. This is because the latter contains a state of affairs ($^{\wedge}Pjm$) that the speaker does not consider possible independently of the more specific state of affairs ($^{\wedge}Pjmb$) to which attention is already drawn. A-Parsimony rules out such attentional redundancy.

A-Parsimony can be considered a weakened version of a descriptive generalization about disjunctions known as "Hurford's Constraint" (Hurford 1974), according to which each disjunct should be possible independently of the other (cf. "independence" in Zimmermann 2000, p.720). According to A-Parsimony, rather, one disjunct may entail the other, provided the weaker disjunct is (epistemically) possible independently of the stronger one. Hurford's Constraint, which is more demanding, is (at least at first sight) falsified by felicitous disjunctions like (9a) and various examples considered earlier (for many more, see Potts, 2013, p.24). (The constraint is still commonly assumed, however, by proponents of a grammatical approach to exhaustivity, who assume (following Hurford) that in apparent counterexamples like (9) the constraint can be satisfied by interpreting each individual disjunct exhaustively (e.g., Chierchia, Fox, and Spector, 2012; Katzir and Singh, 2013).)

A-Parsimony is similar to A-Quality in that both impose requirements to the effect that the speaker must consider certain states of affairs possible. A-Quality requires the speaker to consider each state of affairs possible as such, while A-Parsimony requires a speaker to consider each state of affairs possible independently of any more specific thematic states of affairs – and if no such

specific states of affairs exist the maxim is vacuously satisfied. Without the condition A-Quality($\{a\}$) in the definition of A-Parsimony, compliance with A-Parsimony would have entailed compliance with A-Quality. The reason why I do not combine the two maxims into one is that they are conceptually quite distinct: A-Quality expresses a qualitative requirement, whereas A-Parsimony expresses an in some sense quantitative preference for drawing attention to more rather than less specific states of affairs – it just happens to also involve a qualitative criterion.

Lastly, recall that no analogous maxim of "I-Parsimony" was defined among the I-maxims (chapter 2). In principle, some sort of parsimony requirement on informational intents is conceivable, e.g.:

1. don't intend to provide information that is already common ground; or
2. don't intend to provide the same information twice.

Requirement (i), however, would be redundant given the Reasonable Goal Principle (chapter 2), according to which pieces of information that are already common ground would simply fail to be thematic. (A-Parsimony cannot be left to theme-pragmatics in the same fashion, because it pertains to within-utterance parsimony, rather than parsimony relative to some prior, global parameter such as the common ground or perhaps a common attention state.) Requirement (ii) may in this respect be a more promising candidate for a maxim of "I-Parsimony". But note that a similar non-redundancy requirement should hold also for attentional intents, and isn't captured by A-Parsimony. Rather, these requirements will be captured by the maxim of Manner, to be defined in chapter 4.

3.3 Some results

To gain some further insight into the A-maxims, before we put them to work on exhaustivity, I will present two general results that are analogous to results presented in chapter 2 about the I-maxims. The first is *compliance introspection*: a speaker will always know whether a given intent complies with the maxim of A-Quality, and if thematic competence holds the same is true for A-Relation, A-Quantity and A-Parsimony:

3.6. Fact. PROOF IN APPENDIX

For all normal pragmatic models $\mathbf{M}$ and any constant $\mathcal{A}_i$:

$$\mathbf{M} \models \Box\,\text{A-Quality}(\mathcal{A}_i) \leftrightarrow \text{A-Quality}(\mathcal{A}_i)$$

And if thematic competence holds, for any constant $\mathcal{T}_j$:

$$\mathbf{M} \models \Box\,\text{A-Relation}(\mathcal{A}_i, \mathcal{T}_j) \leftrightarrow \text{A-Relation}(\mathcal{A}_i, \mathcal{T}_j)$$
$$\mathbf{M} \models \Box\,\text{A-Quantity}(\mathcal{A}_i, \mathcal{T}_j) \leftrightarrow \text{A-Quantity}(\mathcal{A}_i, \mathcal{T}_j)$$
$$\mathbf{M} \models \Box\,\text{A-Parsimony}(\mathcal{A}_i, \mathcal{T}_j) \leftrightarrow \text{A-Parsimony}(\mathcal{A}_i, \mathcal{T}_j)$$

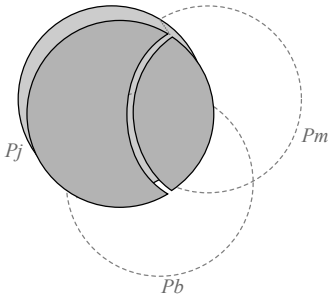


Figure 3.3

As on the informational side, the same cannot be proven for A-Clarity: if a speaker takes something to be common ground, it does not follow that it indeed is.

The second result, which likewise echoes the informational side, is that the A-maxims characterize a unique compliant intent if there is one:

3.7. Fact. PROOF IN APPENDIX

For any normal pragmatic model $\mathbf{M}$, and any theme constant $\mathcal{T}_i$:

$$\mathbf{M} \models \forall\mathcal{A}\forall\mathcal{B}\left(\left(\begin{array}{c}\Box\,\text{A-Maxims}(\mathcal{A},\mathcal{T}_i)\wedge\\ \Box\,\text{A-Maxims}(\mathcal{B},\mathcal{T}_i)\end{array}\right)\rightarrow(\mathcal{A}=\mathcal{B})\right)$$

And this holds also without the modal boxes.

After all, if two attentional intents $\mathcal{A}$ and $\mathcal{B}$ comply with the maxims of A-Quality, A-Relation and A-Parsimony, then so do all their singleton subsets. If in addition they comply with A-Quantity, then they must contain all of these, hence $\mathcal{A}$ and $\mathcal{B}$ are equivalent. Fact 3.7 shows that the A-maxims, like the I-maxims, are to a considerable extent deterministic: given a theme and the speaker's beliefs, if there is a way to comply, we can predict which attentional intent the speaker will be using.

Unlike informational intents, there is a whole class of attentional intents that can never comply with the maxims, in any model. These are attentional intents that violate A-Parsimony regardless of the theme and the speaker's epistemic state: it is never appropriate to intend to draw attention to a state of affairs that is already covered by a set of more specific states of affairs to which attention is intended to be drawn. An example of this type of attentional intent is depicted in figure 3.3, which contains three states of affairs, the one in the background being the union of the two in the foreground. The depicted intent would be expressed by an utterance like the following, which is indeed rather strange:

(10) (?) A: John is at the party, or John and Mary, or John without Mary.

$$\mathcal{A}_0 = \{^\wedge Pj, {}^\wedge Pjm, {}^\wedge(Pj \wedge \neg Pm)\}$$

However, the strangeness of this example could be due to various factors besides A-Parsimony. For this reason the example is not intended as a motivation for the maxim of A-Parsimony, but merely as an illustration.

If we set this class of inevitably A-Parsimony-violating intents aside, then the A-maxims do distinguish all type-theoretically (or set-theoretically) distinct attentional intents that remain: for each attentional intent that can comply with A-Parsimony at all, there is a model in which it can comply with all the A-maxims, hence, by fact 3.7, there exists a model in which it is the *unique* intent that complies.

4 Deriving exhaustivity

Before presenting some general results, I will apply the maxims to a number of concrete examples.

4.1 Examples

Consider first, once again, the contrast with which this chapter started, with the assumed themes and intents as given in (8), repeated here:

(8) a. A: Who (of John, Mary and Bill) is at the party?

$\mathcal{T}_0 = \{^Pj, ^Pm, ^Pb\}^\cap \qquad \mathcal{A}_0 = \{^Pj, ^Pm, ^Pb\}^\cap$

b. B: John is at the party.

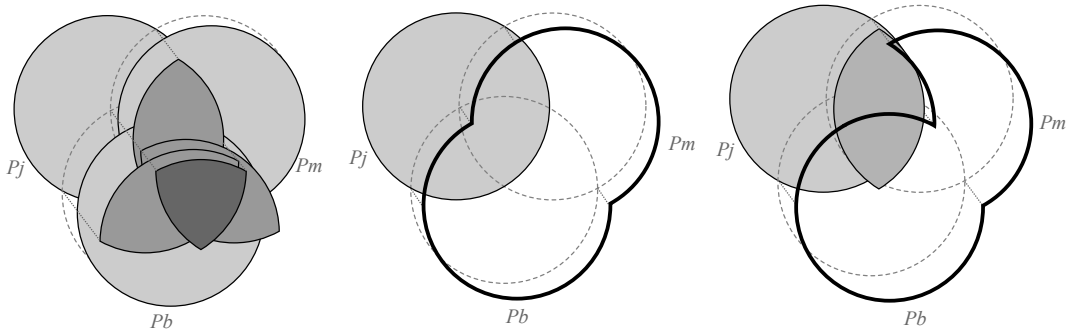
$\mathcal{T}_0 = \{^Pj, ^Pm, ^Pb\}^\cap \qquad p_0 = ^Pj \qquad \mathcal{A}_0 = \{^Pj\}$

c. B: John is at the party, or John and Mary.

$\mathcal{T}_0 = \{^Pj, ^Pm, ^Pb\}^\cap \qquad p_0 = ^Pj \qquad \mathcal{A}_0 = \{^Pj, ^Pjm\}$

The exhaustivity implication we want to derive for (8b) is that B believes that Mary and Bill are not at the party ($\Box\neg Pm$, $\Box\neg Pb$). For (8c) we want to derive the same for Bill ($\Box\neg Pb$), but not for Mary – with regard to Mary we may want to derive merely that the speaker does not consider Mary's presence possible independently of John's ($\Box(Pm \to Pj)$). The desired implications are depicted schematically in figure 3.4, which is identical to figure 3.1 given earlier, except for the bold outlines, which contain those worlds that the exhaustivity implications would exclude from the speaker's epistemic state.

I will derive the exhaustivity implications from the assumption that B takes her attentional intent to comply with A-Quantity (i.e., $\Box$ A-Quantity$(\mathcal{A}_0, \mathcal{T}_0)$), together with thematic competence, i.e., the assumption that B knows what the theme is. In part II it will be explained what could warrant these assumptions.



(a) (b) (c)

Figure 3.4

Formally, to derive the exhaustivity implications from these assumptions is to prove the following:

3.8. Fact. PROOF IN APPENDIX

- For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (8b) that validate thematic competence:

$$\mathbf{M}, w_0 \models \Box \text{ A-Quantity}(\mathcal{A}_0, \mathcal{T}_0) \rightarrow (\Box\neg Pb \wedge \Box\neg Pm)$$

- For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (8c) that validate thematic competence:

$$\mathbf{M}, w_0 \models \Box \text{ A-Quantity}(\mathcal{A}_0, \mathcal{T}_0) \rightarrow (\Box\neg Pb \wedge \Box(Pm \rightarrow Pjm))$$

  And there exists such a model where:

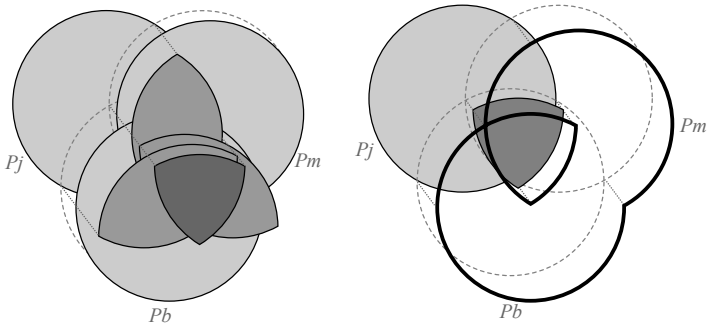
$$\mathbf{M}, w_0 \not\models \Box \text{ A-Quantity}(\mathcal{A}_0, \mathcal{T}_0) \rightarrow \Box\neg Pm$$

  Instead, for all normal pragmatic utterance models we have:

$$\mathbf{M}, w_0 \models \Box \text{ A-Quality}(\mathcal{A}_0) \rightarrow \neg\Box\neg Pm$$

As before, where indicated, proofs for facts and theorems are given in appendix B.

In fact 3.8 the implication for (8c) that Mary's presence is not possible independently of John's ($\Box(Pm \rightarrow Pjm)$) is derived from A-Quantity. Indeed, it follows from its conditioning on A-Parsimony: B did not draw attention to Mary's presence ($^\wedge Pm$), so she must not consider it possible independently of John and Mary's joint presence ($^\wedge Pjm$). But note that the same can be inferred from I-Quality: since the speaker must take the informational intent to be true, she



(a) (b)

Figure 3.5

must believe that John is at the party ($\Box Pj$), but then she will also believe that if Mary is there so is John ($\Box(Pm \to Pjm)$). That is, in all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (8c):

$$\mathbf{M}, w_0 \models \Box \text{ I-Quality}(p_0) \to \Box(Pm \to Pjm)$$

For the pair in (8), then, A-Quantity's conditioning on A-Parsimony is not strictly necessary, because the relevant implication can be derived from I-Quality. For the following example, however, A-Parsimony does make a difference.

An example involving A-Parsimony

Consider again (9a) given earlier, repeated here in (11) (though without the particular speaker beliefs assumed earlier):

(11) B: John is at the party, or John, Mary and Bill.

$$\mathcal{T}_0 = \{^\wedge Pj, {}^\wedge Pm, {}^\wedge Pb\}^\cap \qquad p_0 = {}^\wedge Pj \qquad \mathcal{A}_0 = \{^\wedge Pj, {}^\wedge Pjmb\}$$

Katzir and Singh (2013) claim that an example isomorphic to this (their (8)) is particularly challenging for pragmatic accounts of exhaustivity, which may be true for accounts based on I-Quantity. Let us see how the current account fares.

Figure 3.5(a) and (b) depict the theme and the attentional intent of (11), respectively, in which the bold outline again contains those worlds excluded by the exhaustivity implication from B's epistemic state. The implication is that, according to B, Mary or Bill can be at the party only if everyone is. Unlike before, this implication follows from A-Quantity and not from I-Quality:

3.9. Fact. PROOF IN APPENDIX
For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (11) that validate thematic competence:

$$\mathbf{M}, w_0 \models \Box \text{ A-Quantity}(\mathcal{A}_0, \mathcal{T}_0) \rightarrow \Box(Pm \rightarrow Pjmb)$$

However, there exists a model $\langle \mathbf{M}, w_0 \rangle$ of that sort such that:

$$\mathbf{M}, w_0 \not\models \Box \text{ I-Quality}(p_0) \rightarrow \Box(Pm \rightarrow Pjmb)$$

And likewise for Bill's presence ($\Box Pb \rightarrow Pjmb$).

This shows that the exhaustivity implication of (11), unlike the comparable implication in (8c) above, really depends on A-Quantity and its conditioning on A-Parsimony.

Predicting the theme from the attentional intent

The previous results hold only given certain themes and intents. As I announced earlier, the assumed attentional intents will be motivated in chapter 6. Here I will explain why the themes for B's utterances must be as assumed, given the assumed attentional intents. This motivation relies on another exhaustivity implication, plus three of the theme-pragmatic principles from chapter 2, so it will simultaneously serve as an interesting illustration.

B's utterances are conceived of as responses to an explicit question posed by A. According to the theme-pragmatic Continuity Principle, other things being equal, the theme for B's response will be the theme underlying A's question, or, given the Reasonable Goal Principle, whatever is left of it. Let us therefore figure out which theme must underly A's question, repeated here together with the assumed attentional intent from (8), though this time without assuming any particular theme:

(12) A: Who (of John, Mary and Bill) is at the party?

$\mathcal{A}_0 = \{^\wedge Pj, {}^\wedge Pm, {}^\wedge Pb\}^\cap$

Let us assume that speaker A takes his attentional intent to comply with the maxims of A-Relation and A-Quantity, and assume thematic competence. For his intent to comply with A-Relation, it must be a subset of the theme. That is, for all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (12) that validate thematic competence:

$$\mathbf{M}, w_0 \models \Box \text{ A-Relation}(\mathcal{A}_0, \mathcal{T}_0) \rightarrow (\mathcal{A}_0 \subseteq \mathcal{T}_0)$$

This means that the theme for A's question could be either equivalent to the attentional intent ($\mathcal{A}_0 = \mathcal{T}_0$), or contain additional states of affairs ($\mathcal{A}_0 \subset \mathcal{T}_0$). If

the theme is equivalent to the attentional intent, then, since none of these states of affairs is confirmed or rejected by (pragmatic implications of) A's question, the Continuity Principle predicts that, other things being equal, the exact same theme will also underly B's response. But even if the theme of A's question does contain additional states of affairs these will not end up in the theme underlying B's response, for the following reason.

Suppose that something is thematic for A's utterance to which no attention is drawn, let's say Sue's presence ($^{\wedge}Ps$). A-Quantity then tells us that speaker A must believe that it does not obtain (or at least not independently of something more specific to which attention is drawn), since otherwise he would have drawn attention to it. That is, for all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (12) that validate thematic competence (and in which the theme is "chain-complete", a property that I will explain further below):

$$\mathbf{M}, w_0 \models \Box\,\text{A-Quantity}(\mathcal{A}_0, \mathcal{T}_0) \rightarrow (\mathcal{T}_0(^{\wedge}Ps) \rightarrow \Box\neg Ps)$$

(Indeed, the current account explains exhaustivity of questions and assertions alike, unlike accounts based on I-Quantity; cf. part II.) Now, since speaker B does not protest against this implication, which would be invited by the Common Ground Maintenance Principle, the information that Sue is absent enters the common ground. As a consequence, by the Reasonable Goal Principle, establishing Sue's *presence* ceases to be a goal. And since the same will hold for any potentially thematic state of affairs that is not included in the attentional intent of A's question (say, Chris's presence, $^{\wedge}Pc$), the theme for B's subsequent response will contain only the states of affairs of A's attentional intent.

Hence, regardless of the precise theme underlying A's question, if A's question complies with the maxims, then the theme of B's response will be equivalent to the attentional intent of A's question. This prediction is worth making explicit:

3.10. Prediction. In explicit question-answer sequences, other things being equal, if the question is taken to comply with the maxims then the theme of the answer will be equivalent to the attentional intent of the question.

This prediction is what motivates the assumed theme for B's responses – and it shows that the theme for A's responses could in principle be larger than assumed, without this making a difference for B. Of course, the attentional intent of A's question remains to be motivated (chapter 6), as well as the assumption of compliance with the maxims (part II).

4.2 General result

To derive a more general result of the current account, let us restrict our attention to cases where the set of what is potentially thematic has the property of *chain*

completeness, for reasons to be explained further below. In a nutshell, this means that for every chain of more and more specific, potentially thematic states of affairs, their infinitary intersection is also potentially thematic. The following can be proven:

3.11. Theorem. PROOF IN APPENDIX

For all normal pragmatic models $\mathbf{M}$, for arbitrary constants $\mathcal{A}_i$ and $\mathcal{T}_j$, where the set of potentially thematic states of affairs is chain-complete:

$$\mathbf{M} \models \Box\,\text{A-Quantity}(\mathcal{A}_i, \mathcal{T}_j) \rightarrow \forall a \left(\begin{array}{l} (\Diamond \mathcal{T}_j(a) \wedge \neg \mathcal{A}_i(a)) \rightarrow \\ \qquad \Box(\neg^{\vee} a \vee \exists b(\mathcal{A}_i(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)$$

If $\mathbf{M}$ in addition satisfies thematic competence, then:

$$\mathbf{M} \models \Box\,\text{A-Quantity}(\mathcal{A}_i, \mathcal{T}_j) \rightarrow \forall a \left(\begin{array}{l} (\mathcal{T}_j(a) \wedge \neg \mathcal{A}_i(a)) \rightarrow \\ \qquad \Box(\neg^{\vee} a \vee \exists b(\mathcal{A}_i(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)$$

And if $\mathbf{M}$ in addition satisfies factivity, then:

$$\mathbf{M} \models \Box\,\text{A-Quantity}(\mathcal{A}_i, \mathcal{T}_j) \rightarrow \forall a \left(\begin{array}{l} (\mathcal{T}_j(a) \wedge \neg \mathcal{A}_i(a)) \rightarrow \\ \qquad (\neg^{\vee} a \vee \exists b(\mathcal{A}_i(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)$$

According to the first result in the theorem, compliance with A-Quantity (according to the speaker) implies that, for every state of affairs that is potentially thematic and to which no attention is intended to be drawn, the speaker must think that it does not obtain or that, if it does obtain, a more specific state of affairs obtains to which attention is drawn. According to the second result, with thematic competence, we may conclude the same not just for any potentially thematic state of affairs, but for any *actually* thematic state of affairs. (Strictly speaking, full thematic competence is not necessary for this result: it suffices if the speaker's beliefs about what *isn't* in the theme are accurate.) The third result is a further strengthening (or simplification) for models in which the speaker's beliefs are accurate: every thematic state of affairs to which no attention is drawn is either false, or only true together with a more specific state of affairs to which attention is drawn.

Even the first result in the theorem, without factivity and thematic competence, is still what would be called in the literature a "strong" exhaustivity implication (e.g., Matsumoto, 1995; Geurts, 2011): negative belief ($\Box\neg^{\vee} a$), rather than the lack of positive belief ($\neg\Box^{\vee} a$). Put differently, the "epistemic step" between I-Quantity and exhaustivity (Sauerland, 2004) does not exist between A-Quantity and exhaustivity. This is why the current account does not require a competence assumption of the sort discussed in section 2.

The chain completeness restriction To understand the chain completeness restriction of theorem 3.11, let us briefly consider what may happen if what is (potentially) thematic is not chain-complete (for details the reader may consult the proof in appendix B). This means that there exists a chain of ever more specific, (potentially) thematic states of affairs, without their infinitary intersection being potentially thematic. An example of a theme that is not chain-complete could be the one underlying "(at least) how many natural numbers are there?", but without the state of affairs of there being infinitely many. Relative to such a (hypothetical, artificial) theme, suppose that a speaker would not intend to draw attention to a certain state of affairs in the chain, say, to there being (at least) 10 natural numbers, nor to any of the infinitely many more specific states of affairs (at least 11, 12, ...). Now we cannot be sure whether no attention was drawn to these states of affairs because (a) the speaker does not consider *any* of them possible (i.e., she thinks that there are only 9 natural numbers), or because (b) she considers *all* of them possible but not independently of each other (i.e., she knows that there are infinitely many natural numbers). By restricting theorem 3.11 to situations where what is potentially thematic is chain-complete, option (b) can be safely ignored, letting us conclude option (a) instead, which gives us a simpler and more practical formulation of the main results.

The chain completeness restriction is only a presentational choice; it is not indicative of some sort of defect in the maxims. I don't think that, relative to a theme that is not chain-complete, a speaker could rationally behave differently from what the current maxims predict, namely, to not draw attention to any particular state of affairs in the chain. If anything, a rational speaker may want to consider addressing a chain-complete theme instead, e.g., the same theme but including the state of affairs of there being infinitely many natural numbers, or, if the speaker lacks the concept of infinity, she may consider simply asking "are there more than 1000?". This is a matter for theme-pragmatics to explain, not rheme-pragmatics.

4.3 An "exhaustivity operator"

It will be convenient, for instance for a comparison with the literature, to define a notational shorthand for the third result of theorem 3.11:

3.12. Definition. For $\mathcal{A}$ and $\mathcal{T}$ any constant or variable of type $\langle\langle s,t\rangle,t\rangle$, let the following notational shorthand be defined:

$$\textsc{Exh}(\mathcal{A},\mathcal{T}) \stackrel{\text{def}}{=} \lambda\mathcal{T}'\left(\lambda\mathcal{A}'\,{}^{\wedge}\forall a\left(\begin{array}{c}(\mathcal{T}'(a)\wedge\neg\mathcal{A}'(a))\rightarrow\\ (\neg^{\vee}a\vee\exists b(\mathcal{A}'(b)\wedge(b\subset a)\wedge{}^{\vee}b))\end{array}\right)(\mathcal{A})\right)(\mathcal{T})$$

(The lambdas ensure that, in case $\mathcal{A}$ and $\mathcal{T}$ are constants, they are interpreted in the world of evaluation; cf. the definition of, e.g., intent introspection in chapter 2.) Although I will refer to Exh as an "exhaustivity operator", as is

common in the literature, it is intended merely as a notational shorthand, not as a substantive assumption or component of the theory. The operator simply captures the exhaustivity implications that are predicted by the theory anyway, given factivity, thematic competence and compliance with A-Quantity. The result of applying the operator can also be formulated, in the metalanguage, in a more set-theoretical fashion:

3.13. Fact. PROOF IN APPENDIX

For arbitrary constants or variables $\mathcal{A}$ and $\mathcal{T}$:

$$[\![\textsc{Exh}(\mathcal{A},\mathcal{T})]\!] = \bigcap_{\substack{a\in[\![\mathcal{T}]\!]\\ a\notin[\![\mathcal{A}]\!]}} (\overline{a} \cup \bigcup_{\substack{b\in[\![\mathcal{A}]\!]\\ b\subset a}} b)$$

(Parameters $\mathbf{M}, w, g$ for $[\![.]\!]$, omitted for readability, are the same throughout.)

This is fairly easy to see: the universal quantifier in definition 3.12 corresponds here to generalized intersection; negation to complementation, disjunction to union, the existential quantifier to generalized union, and the rest are mere notational differences. Note also that the complements of the bold outlines in figures 3.4 and 3.5 given earlier correspond precisely to the sets of worlds characterized by the exhaustivity operator, when applied to the relevant themes and intents.

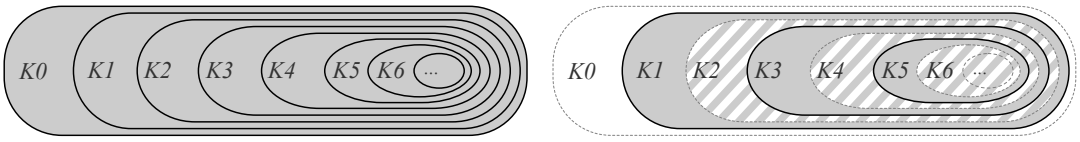
The operator might make one prone to forget all the assumptions involved in the derivation of exhaustivity implications. Without factivity, we cannot conclude anything about the world as such, only about the speaker's beliefs. Without thematic competence, we must leave room for the possibility that the speaker refrained from drawing attention to a certain thematic state of affairs merely because she mistook it to be athematic. Next, getting rid of the belief axioms will hide most of the potentially interesting implications beneath impenetrable layers of boxes and diamonds. By in addition giving up the assumption that the speaker takes the maxims to be complied with, we may infer only that she tried her best to comply. And by giving up the assumption of rationality, we cannot really infer anything except that the speaker produced some sounds. The risk of forgetting all of this notwithstanding, let us apply the operator to an example.

Example

Let us consider a slightly more interesting case than before:

(13) A: How many kids does John have?

$$\mathcal{A}_0 = \{\hat{}K0, \hat{}K1, \hat{}K2, \hat{}K3, \hat{}K4, \ldots\}$$



(a) (b)

Figure 3.6

B: John has one, three, or five kids.

$\mathcal{T}_0 = \{\text{^}K0, \text{^}K1, \text{^}K2, \text{^}K3, \text{^}K4, \ldots\}$
$p_0 = \text{^}K1$ (equivalent to $\text{^}(K1 \vee K3 \vee K5)$)
$\mathcal{A}_0 = \{\text{^}K1, \text{^}K3, \text{^}K5\}$

Here, Kn is to be read as "John has n kids". I assume an "at least"-interpretation of numerals, e.g., that if John has 3 kids, he therefore also has 2 kids, i.e., $K3 \to K2$. This treatment of numerals is not uncontroversial (for recent discussion see Kennedy, 2013), but the essential structure of the example could be replicated using a "who"-question and disjunctions of conjunctions, as in (11) further above, avoiding numerals at the cost of longer and more artificial utterances. The theme and the attentional intent of (13B), as given in the example, are depicted in figure 3.6(a) and (b), respectively. The nesting of states of affairs reflects the assumed "at least"-interpretation of numerals. The striped regions in figure (b) together contain the worlds that are excluded by the exhaustivity operator (like the bold outlines before), which can be computed as follows.

For readability I will now write bare numerals n as a shorthand for $\text{^}Kn$, i.e., the state of affairs of John having at least n kids. The following equivalences then hold in any utterance model for (13B), in w_0 (where $\mathcal{A}_0$ and $\mathcal{T}_0$ have their actual denotations):

$$\begin{aligned}
\textsc{Exh}(\mathcal{A}_0, \mathcal{T}_0) &= (\overline{0} \cup 1 \cup 3 \cup 5) \quad \cap \quad (\overline{2} \cup 3 \cup 5) \quad \cap \quad (\overline{4} \cup 5) \quad \cap \overline{6} \cap \overline{7} \cap \ldots \\
&= \quad 1 \quad \cap \quad (\overline{2} \cup 3) \quad \cap \quad (\overline{4} \cup 5) \quad \cap \overline{6} \\
&= (1 \cap \overline{2} \cap \overline{4} \cap \overline{6}) \cup \ldots \cup (1 \cap 3 \cap \overline{4} \cap \overline{6}) \cup \ldots \cup (1 \cap 3 \cap 5 \cap \overline{6}) \\
&= \quad (1 \cap \overline{2}) \quad \cup \quad (3 \cap \overline{4}) \quad \cup \quad (5 \cap \overline{6})
\end{aligned}$$

The step from the second to the third line involves distributing unions over intersections, and eliding ("...") from the result all intersections that result in the empty set. The last line says that John has exactly one, exactly three, or exactly five kids. Formally:

3.14. Fact. For all utterance models $\langle \mathbf{M}, w_0 \rangle$ for (13B):

$$\mathbf{M}, w_0 \models \textsc{Exh}(\mathcal{A}_0, \mathcal{T}_0) = (\text{^}K1 \cap \overline{\text{^}K2}) \cup (\text{^}K3 \cap \overline{\text{^}K4}) \cup (\text{^}K5 \cap \overline{\text{^}K6})$$

The set of worlds thus computed corresponds to the gray, non-striped region in figure 3.6b.

Comparison to existing operators

The main contribution of the current chapter has been a new type of explanation for exhaustivity, in terms of attention rather than information, i.e., A-Quantity rather than I-Quantity. We have already seen the potential improvements this gives us on a descriptive level: unlike accounts based on I-Quantity, the current proposal predicts exhaustivity in the absence of a competence assumption, it distinguishes between (1) and (2) and other variants, and it predicts that exhaustivity can be also implied by questions (see chapter 12 for a more detailed account), and arguably by the hints of a quizmaster.

For a more systematic assessment of its descriptive accuracy, we can compare the current exhaustivity operator, as a purely formal device, to existing exhaustivity operators in the literature. These operators are used not only as a notational shorthand for a purported pragmatic inference (as in Schulz and Van Rooij 2006; Spector 2007), but also as a merely descriptive tool (Groenendijk and Stokhof, 1984), or as a purported syntactic/semantic operator in the grammatical approach (e.g., Fox, 2007; Chierchia, Fox, and Spector, 2012; Katzir and Singh, 2013). I will consider three operators: the "minimal worlds" operator $\textsc{Exh}_{\text{mw}}$ discussed in Spector 2016 (attributed to Spector 2007 and Schulz and Van Rooij 2006), an "innocent exclusion" operator $\textsc{Exh}_{\text{ie}}$ from Alonso-Ovalle 2008 (based on the notion of innocent exclusion from Fox 2007), and a "dynamic" operator $\textsc{Exh}_{\text{dyn}}$ from Schulz and Van Rooij 2006 (Spector discusses only a simplified version).

I will state a number of correspondences between these existing operators and the current one, though leaving the details and proofs to appendix B. Each correspondence will be stated and proven only for the intersection of circumstances in which the current operator can be derived from compliance with A-Quantity, and circumstances to which the other operator was intended to apply. I will capture the former in the notion of *operational model*:

3.15. Definition. **Operational model:** A normal, pragmatic utterance model $\langle \mathbf{M}, w_0 \rangle$ is *operational* if it validates factivity and thematic competence, in w_0 the relevant intents comply with the maxims relative to the relevant themes, and the set of potentially thematic states of affairs in w_0 is chain-complete.

Outside the class of operational models the current operator is unmotivated and a comparison to the literature is meaningless. I will return to this restriction further below.

Minimal worlds operator To investigate the "minimal worlds" operator (Schulz and Van Rooij, 2006; Spector, 2007; Spector, 2016) let us temporarily add $\textsc{Exh}_{\text{mw}}$ to the language, with the following semantics:

3.16. Definition. For arbitrary constants/variables p and $\mathcal{T}$, let:

$$[\![\textsc{Exh}_{\text{mw}}(p, \mathcal{T})]\!] \stackrel{\text{def}}{=} \{w \in [\![p]\!] \mid \text{there is no } w' \in [\![p]\!] \text{ such that: } \{a \mid a \in [\![\mathcal{T}]\!], w' \in a\} \subset \{a \mid a \in [\![\mathcal{T}]\!], w \in a\}\}$$

(As before, the omitted parameters of $[\![.]\!]$ are the same everywhere.)

That is, the proposition denoted by p must be true in the relevant worlds w, together with a set of other thematic propositions that is *minimal* compared to the sets of true thematic propositions in other worlds w' in which the proposition denoted by p is true.

The minimal worlds operator aligns with the current operator if the attentional intent is a singleton set:

3.17. Fact. PROOF IN APPENDIX

Take any utterance with intents denoted by p_i and $\mathcal{A}_j$ such that $\mathcal{A}_j = \{p_i\}$ is true, and theme denoted by $\mathcal{T}_k$. For any normal, pragmatic, operational utterance model $\langle \mathbf{M}, w_0 \rangle$ for such an utterance:

$$\mathbf{M}, w_0 \models \textsc{Exh}_{\text{mw}}(p_i, \mathcal{T}_k) = p_i \cap \textsc{Exh}(\mathcal{A}_j, \mathcal{T}_k)$$

This result shows that the operators align when attention does not really matter, i.e., when all we have is information. Our operators diverge when attention does make a difference: unlike the current operator, $\textsc{Exh}_{\text{mw}}$ cannot distinguish between (1) and (2) with which this chapter started, nor does it account for the exhaustivity implications of examples like (11) and (13) discussed above.

I refer to Spector 2016 for a detailed comparison of the operator $\textsc{Exh}_{\text{mw}}$ to other existing operators from Krifka 1993 and Fox 2007. None of these operators can distinguish between (1) and (2) – they all feed on information only. (The reason why they have nevertheless remained in use is that, as I mentioned earlier, proponents of the grammatical approach to exhaustivity try to distinguish (1) and (2) in a very different way: by applying an exhaustivity operator to each disjunct separately.) In the remainder of this section I will concentrate on two operators that do distinguish (1) and (2), and with which the current operator corresponds more closely.

Innocent exclusion operator The operator of Alonso-Ovalle (2008) is formulated in terms of *Alternative Semantics*, but it can be readily applied to attentional intents (see chapter 6 for a comparison of these and similar notions). It relies on a set of *innocently excludable* propositions, a notion adopted from Fox 2007:

3.18. Definition. For A a set of propositions, and $A^{\cap}$ its closure under intersection, let:

$$\text{IE}(A) \stackrel{\text{def}}{=} \{a \in A^{\cap} \mid \text{for all } b \in A, \text{ any way of excluding from } b \text{ as many } a' \in A^{\cap} \text{ as consistency allows, excludes also } a\}$$

And for an arbitrary constant/variable $\mathcal{A}$, let:

$$[\![\text{Exh}_{\text{ie}}(\mathcal{A})]\!] \stackrel{\text{def}}{=} \bigcup [\![\mathcal{A}]\!] \cap \bigcap_{a \in \text{IE}([\![\mathcal{A}]\!])} \overline{a}$$

(As before, the omitted parameters of $[\![.]\!]$ are the same everywhere.)

This operator aligns with the current one as far as (1) and (2) go. However, for the variant in (11), "John, or John, Mary and Bill", it fails to predict exhaustivity, and similarly for (13), "one, three or five". One problem is that Alonso-Ovalle does not derive the theme from some preceding question, but computes it from the utterance itself by taking the set of disjuncts and closing this set under intersection.

A more fundamental problem is that his operator never excludes *part* of a proposition, like in (11) the part of the proposition denoted by $^{\wedge}Pjm$ that is not contained in the proposition denoted by $^{\wedge}Pjmb$ (i.e., a proposition is not "innocently excludable" if it contains a proposition that isn't); this is what the current approach achieves through A-Parsimony. Still, for a restricted set of cases our operators are formally equivalent:

3.19. Fact. PROOF IN APPENDIX

Take any utterance with intents denoted by p_i and $\mathcal{A}_j$ and theme denoted by $\mathcal{T}_k$ such that the following is true:

- $p_i = \bigcup \mathcal{A}_j$;
- $\mathcal{T}_k = \mathcal{A}_j^{\cap}$; and
- $\forall a((\mathcal{T}_k(a) \wedge \neg \mathcal{A}_j(a)) \rightarrow \neg \exists b(b \subset a \wedge \mathcal{A}_j(b)))$.

For any normal, pragmatic, operational utterance model $\langle \mathbf{M}, w_0 \rangle$ for such an utterance:

$$\mathbf{M}, w_0 \models \text{Exh}_{\text{ie}}(\mathcal{A}_j) = (p_i \cap \text{Exh}(\mathcal{A}_j, \mathcal{T}_k))$$

The third bullet excludes cases where mere parts of propositions need to be excluded, like (11), in which case Exh_{ie} delivers the wrong results.

Dynamic operator The operator $\textsc{Exh}_{\text{dyn}}$ of Schulz and Van Rooij 2006 is very similar to the "minimal worlds" operator $\textsc{Exh}_{\text{mw}}$, the difference being that $\textsc{Exh}_{\text{dyn}}$ does not minimize the set of true thematic propositions among *all* worlds in the informational intent, but only within certain subsets. I will bypass the details of how they determine these subsets, a matter for which they use *dynamic semantics* – roughly, they compare only world-assignment pairs that share the same assignment (discourse referents). At least for disjunctive utterances, which they assume introduce a discourse referent for each disjunct, this amounts simply to comparing only worlds within some state of affairs in the attentional intent. This is how I (re)define their operator:

3.20. Definition. For arbitrary constants/variables $\mathcal{A}$, and $\mathcal{T}$, let:

$$[\![\textsc{Exh}_{\text{dyn}}(\mathcal{A},\mathcal{T})]\!] = \{w \mid \text{for some } a \in [\![\mathcal{A}]\!]\text{: } w{\in}a \text{ and there is no } w'{\in}a \text{ s.t. } \{b \mid b \in [\![\mathcal{T}]\!], w'{\in}b\} \subset \{b \mid b{\in}[\![\mathcal{T}]\!], w{\in}b\}\}$$

(As before, the omitted parameters of $[\![.]\!]$ are the same everywhere.)

Whether this definition corresponds exactly to theirs depends on the degree to which the current attentional intents align with what they consider to be discourse referents. For present purposes I will assume that it does; I will say more about the relation between the two notions in chapter 6.

The operator of Schulz and Van Rooij 2006 can distinguish between (1) and (2), as well as account for the exhaustivity implications of (11) and (13), unlike the operator based on innocent exclusion. Indeed, our operators align quite generally:

3.21. Fact. PROOF IN APPENDIX

Take any utterance with intents denoted by p_i and $\mathcal{A}_j$ and a theme denoted by $\mathcal{T}_k$, and for which the following is true:

- $p_i = \bigcup \mathcal{A}_j$; and
- $\mathcal{T}_k = \mathcal{T}_k^{\cap}$.

For any normal, pragmatic, operational utterance model $\langle \mathbf{M}, w_0 \rangle$ for such an utterance:

$$\mathbf{M}, w_0 \models \textsc{Exh}_{\text{dyn}}(\mathcal{A}_j, \mathcal{T}_k) = (p_i \cap \textsc{Exh}(\mathcal{A}_j, \mathcal{T}_k))$$

This result highlights that the contribution of the current chapter is not the exhaustivity operator in itself but its explanation in terms of (i.e., derivation from) Attentional Pragmatics. In contrast, Schulz and Van Rooij offer only a partial explanation for their operator. In particular, they do not motivate its sensitivity

to discourse referents, which is precisely what gives it an edge over the other operators. Moreover, the part which they do motivate (basically EXH_{mw}) relies on I-Quantity plus a competence assumption, which means that despite the formal correspondence between our operators, our accounts make different predictions.

Cautionary remark

The above correspondences are restricted to "operational models", i.e., where utterances comply with the maxims. This is because the current operator represents the outcome of a derivation from more basic assumptions, most centrally the assumption of compliance with A-Quantity, but also, for instance, the assumption that the given theme can be compliantly addressed at all. If these assumptions are false, then the operator may well deliver nonsense, the above correspondences may not hold, and a comparison to existing operators, whether favorably or unfavorably, would simply be meaningless.

Indeed, application of the current exhaustivity operator is not warranted nearly as often as the frequent reliance on exhaustivity operators in the literature would require. This holds, for instance, for the embedded operators that grammaticalists assume, but also for certain unembedded occurrences. For instance, Schulz and Van Rooij (2006) apply their exhaustivity operator directly to negative answers to positive questions, conditional answers to unconditional questions, and modalized answers to non-modalized questions. These are cases for which the current theory predicts a thematic discontinuity, which means that we must not apply the current exhaustivity operator directly to the theme of the question and the attentional intent of the answer. This does not mean that the current theory makes no predictions in those cases – subsequent chapters will cover various theme-pragmatic discontinuities. Rather, it highlights that the current exhaustivity operator abbreviates only a rather small part of the theory – and that the operator of Schulz and Van Rooij is more ambitious, at least descriptively.

Schulz and Van Rooij (2006) motivate their ambition as follows:

> "[N]one of these [existing] theories gives a satisfying explanation for why the scope of exhaustive interpretation should be restricted to those cases that they can actually handle."
>
> (Schulz and Van Rooij 2006, p.8)

But the converse is true as well: none of these existing theories, including Schulz and Van Rooij's, gives a satisfying explanation for why the cases that they appear to handle are cases that they *should* handle. If all you have is a hammer, everything looks like a nail (e.g., Maslow, 1966). It is only by acknowledging the limited applicability of the current exhaustivity operator (and the unknown applicability of existing ones) that we may begin to see subtle theme-pragmatic differences between the types of conversational goals that are normally served by positive and

negative answers, conditional and unconditional answers, or plain and modalized answers, even though these may often be intuitively relevant in response to the same types of questions. Some of these differences will be discussed in subsequent chapters.

5 Conclusion and discussion

This chapter presented a new solution to several known problems for existing accounts of exhaustivity based on I-Quantity. It relied on a new type of communicative intention: attentional intent. Five A-maxims constrain the rational employment of attentional intents, which together with the I-maxims (chapter 2) and the maxim of Manner (to be defined in chapter 4), constitute the theory of Attentional Pragmatics. Exhaustivity implications follow from the assumption of compliance with the maxim of A-Quantity. The implications generated by this maxim were abbreviated by an exhaustivity "operator", which, when its application is warranted, is formally equivalent to the operator of Schulz and Van Rooij 2006.

The remainder of this dissertation will address several fundamental questions that have been left open at this point – I will here highlight only the questions that pertain most directly to exhaustivity:

- Chapter 4: do utterances that imply exhaustivity also have an exhaustivity *implicature* in the sense of Grice 1989? What about *impliciture* in the sense of Bach 1994?
- Chapter 5: what if themes are closed under negation (the symmetry problem)?
- Chapter 6: what warrants the assumption of a particular attentional intent?
- Chapter 7: what warrants the assumption of compliance with the maxims?
- Chapter 11: what explains the (non-)exhaustivity effects of the "rise-fall-rise" intonation contour?
- Chapter 12: what explains the exhaustivity effects of (interrogative) questions?

More generally, the novel account of exhaustivity presented in this chapter invites a substantial but primarily conceptual revision of the extensive literature on the topic, that I will not at present undertake.

Chapter 4

On contents, direct intents and indirect intents

> Confusion in terms inspires confusion in concepts. [...] No one disputes that there are various ways in which what is communicated in an utterance can go beyond sentence meaning. The problem is to catalog the ways.
>
> (Bach 1994, p.124)

1 Introduction

The distinction between contents and intents is central to the field. It is a distinction, roughly, between what sentences mean and what speakers mean by them, and it marks the border between semantics and pragmatics (as conceived in chapter 2). Previous chapters have dealt almost exclusively with intents: the I-maxims and the A-maxims constrain which informational and attentional intents a rational speaker may employ, given the theme and the speaker's beliefs, and demand that these intents be clearly conveyed (I/A-Clarity). But none of these maxims constrains which contents a speaker may use in order to actually achieve clear communication.

It is commonly assumed that intents can be clearly conveyed in two basic ways: *directly* by means of the sentence's contents, and *indirectly* via inference based on contextual assumptions, where the latter corresponds to the Gricean (1989, ch.2) notion of *(conversational) implicature*. The current chapter presents a basic understanding of these two ways of conveying intents. In order to capture the first, direct way, I will present a partial, semi-formal definition of a maxim of Manner, which is the primary maxim that links contents to intents. In the spirit of Grice this maxim will have submaxims of clarity, conciseness and orderliness. None of these submaxims will be really new, but they are not often made explicit. For an account of the second, indirect way of conveying intents we will not really need

anything extra, as I will show by discussing in detail two examples of purported implicature: *indirect answers* and *exhaustivity implicature* (or "quantity/scalar implicature").

The main aim of this chapter is not to present an account of a certain empirical phenomenon, but rather to achieve conceptual clarity with regard to the notions of content and intent, and thereby an adequate understanding of related notions such as entailment, implication, implicature, impliciture and inference. For although these notions are central to the field (and to this dissertation), they are surrounded by misconceptions – see, e.g., Bach 2006 for a top ten. Towards the end of this chapter, after presenting the maxim of Manner and illustrating the two ways in which intents can be conveyed, I will concentrate on one particularly common misconception: that pragmatic implications and/or implicatures would in some sense be "weaker" than semantic entailments.

Outline Section 2 introduces the maxim of Manner and discusses its various submaxims. Section 3 introduces the distinction between directly conveyed and indirectly conveyed intents, and presents two detailed illustrations. Section 4 addresses the misconception that implicatures or pragmatic implications would be weaker than semantic entailments. Section 5 concludes and outlines how subsequent chapters will build on the current one.

2 From content to intent

This section presents a partial definition of the maxim of Manner. Most submaxims to be defined will play a role in this chapter, but some will be relied upon only in subsequent chapters and are included here only for the sake of completeness. After briefly presenting the various submaxims, I will zoom in on the submaxim that is primarily responsible for the relation between contents and intents.

2.1 The maxim of Manner

The maxim of Manner has several submaxims:

4.1. Definition. **Maxim of Manner:**
An utterance complies with the maxim of Manner if and only if:

(i) **Clarity**, which includes as submaxims (a.o.):

- **Content Efficacy**: the possible intents that are most directly associated with the contents must actually be intents; and

- **Compliance Transparency**: it must be commonly understood whether you take your utterance to comply with the maxims, and relative to which theme(s).

(Other aspects of Clarity, recall, are already covered at the level of intents, by I/A-Clarity.)

(ii) **Conciseness**: what is uttered is as concise as maximizing expected compliance with the other maxims allows.

(iii) **Orderliness**, which includes as a submaxim (a.o.):

- **Prominence Alignment**: the relative prominence of intents aligns (as much as the other maxims allow) with the relative precedence of the themes they address.

I will briefly discuss each of its submaxims, after which I will return to Content Efficacy in more detail. Because none of these submaxims will be formalized, let us assume that the designated constant MANNER is always true in any pragmatic model (cf. chapter 2), so that reference to Manner within the formalism will not interfere with the rest of the formalization.

Content Efficacy Clarity (roughly Grice's "be perspicuous!") and its submaxim of Content Efficacy are the main link between semantics and pragmatics. Content Efficacy will be explained in more detail below, but roughly: it requires that everything that will appear to an audience as an intent of the utterance, given the linguistic conventions, must actually be an intent. As such it complements the maxims of I/A-Clarity, which require essentially the converse: every actual intent must appear as such, i.e., be recognized. Content Efficacy corresponds, for instance, to (part of) the Linguistic Presumption in Bach and Harnish 1979, that the speaker will comply with linguistic conventions. Its formulation resembles the central principle of Relevance Theory (Sperber and Wilson, 1986b). This maxim will be discussed in more detail below.

Compliance Transparency Grice (1989, ch.2) already proposed that cooperative speakers do not secretly violate a maxim. That it must be clear which themes (or something like it) are being addressed is arguably implicit in much work on questions under discussion, but made explicit at least by Büring (2014, his "identifiability" constraint). Moreover, Compliance Transparency may already be implied by the maxim of I-Clarity in the case of conversational implicatures, as will become clear further below.

Ensuring Compliance Transparency becomes a new conversational goal in itself, through the theme-pragmatic Clarification Principle (chapter 2). For any theme

$\mathcal{T}$ addressed, the following theme will be evoked, the Reasonable Goal Principle permitting (the latter prevents an infinite regress):

$$\{^\Box \textsc{Maxims}(\mathcal{T}), ^\neg\Box \textsc{Maxims}(\mathcal{T})\}$$

In some cases it may be obvious to an audience that a maxim is being violated, a type of situation that Grice called "flouting a maxim" (1989, ch.2, p.30). But in many cases we should expect to find more or less explicit signals of (non-) compliance, such as hedges (e.g., "not sure if this is relevant, but..."), intonational cues like a final rising pitch, and gestural cues like a raised eyebrow or a shoulder shrug. It will not necessarily be easy to establish whether these various cues indeed convey (non-)compliance with the rheme-pragmatic maxims rather than, say, the theme-pragmatic principles or something else altogether. But in part II of this dissertation a case will be made that certain intonational features serve exactly the current, rheme-pragmatic sort of Compliance Transparency.

The precise formulation of Compliance Transparency embodies a number of assumptions that should ultimately be explained, but which will in this dissertation be mostly taken for granted, i.e., motivated primarily empirically. For instance, Compliance Transparency presupposes that rational speakers may sometimes *suspend* (i.e., risk violating or even knowingly violate) a maxim – otherwise there would be no need for it. This may seem uncontroversial, as Grice already assumed that maxims sometimes *clash*, i.e., cannot be jointly complied with. But it is a substantive assumption nevertheless, in two respects: (i) whether the maxims genuinely clash depends on how exactly they are defined; and (ii) whether speakers will in case of a clash suspend a rheme-pragmatic maxim rather than theme-pragmatically shifting to a less problematic theme depends on the strength of the Continuity Principle compared to the maxims. Another substantive assumption underlying Compliance Transparency is that ascertaining compliance with the maxims would be worth sharing, i.e., that it would somehow be relevant to the goals of the conversation. The question of why this should be so seems to me, at least in full generality, no less difficult than the question of why the maxims are the way they are, and this lies outside the scope of this dissertation. Nevertheless, for some maxims it may be quite clear, e.g., until the audience knows that the speaker takes a certain intent to comply with I-Quality, the intent cannot become common ground. As for why Compliance Transparency cares about compliance *according to the speaker* (i.e., the modal boxes in the above theme), perhaps this may be understood as ensuring that a rational speaker will always be able to comply with Compliance Transparency: given positive and negative introspection, she will always know whether or not she believes that the maxims are complied with.

Conciseness This submaxim will not play an important role in this dissertation – rather, its unimportance in general will play a role in chapter 5, when critically

examining conciseness-based approaches to the "symmetry problem". As such, an informal characterization will suffice: I take conciseness to imply that every part of an uttered sentence contributes to (or even: is necessary for) the clear communication of some kind of intent. This captures a type of non-redundancy requirement, that, recall from chapter 2, could not by an I-maxim (or A-maxim). After all, some part of an utterance that is informationally redundant may still make an attentional contribution, and something that is redundant relative to one theme may still serve to address another. Note that the maxim of Conciseness breaches the border between semantics and rheme-pragmatics, by (presumably) requiring access to the surface form of what is uttered, and not just the semantic contents expressed.

Prominence Alignment Intents can be communicated in various ways, e.g., explicitly or implicitly, by means of intonation, gestures, and by means of various syntactic constructions. I assume that these various ways may lend different degrees of *prominence* to the intents thus communicated, with the matrix clause of the sentence yielding the greatest prominence, followed by, say, interjections, appositives, and non-restrictive relative clauses, and then evaluatives, evidentials, discourse particles and intonation. Gestures could perhaps occupy the whole spectrum, depending on their conspicuousness. The maxim of Prominence Alignment requires that the prominence of an intent, as determined by the way in which it is conveyed, aligns with the precedence (importance, priority) of the theme it addresses.

Prominence Alignment can explain, for instance, why (1a) is a more canonical way of addressing A's question than (1b), despite both responses arguably providing the same information:

(1) A: Who invited whom to the party?
  a. B: John, who is Mary's brother, invited Bill.
  b. (?) B: John, who invited Bill, is Mary's brother.

Each of B's responses can be analyzed as having the same two intents, the contrast residing in whether the (supposed) main theme, i.e., the theme with the highest precedence, is addressed by the matrix clause or by the relative clause. More generally, I intend Prominence Alignment to explain at least in part the well-known fact that certain constructions, like non-restrictive relative clauses, tend to convey *side intents*, or "non-at-issue" information (e.g., Potts 2005; Simons et al. 2010; Horn 2014; Gutzmann 2015), reminiscent of Grice's (1989, ch.2) "conventional implicature".

Because the notion of prominence can be spelled out in various ways, the maxim itself is neutral in principle between syntactic/semantic approaches and more pragmatic approaches to non-at-issueness. For instance, Potts and Gutzmann treat expressions like non-restrictive relative clauses as contributing a separate

dimension of semantic content, computed compositionally in parallel to the main semantic content. In contrast, Simons et al. (p.322) argue that the relation between ways of expression and non-at-issueness is not in general syntactically predetermined, e.g., that relative clauses are sometimes used to address the main theme. The latter might suggest that we analyze (1a) and (1b) rather as having the same, single semantic content (that John is Mary's brother and invited Bill), and conceive of prominence as a separate, gradient (quantitative) measure that is somehow superimposed.

In order to remain neutral between the more syntactic/semantic and the more pragmatic approach (and to avoid considerable complexities of implementing either), I will not formalize the notion of prominence, and speak of it only at the level of intents, i.e., where the two distinct approaches agree. At the formal level, I will simply adopt a notational convention: the numerical indices of constants for themes, intents and contents will be indicative of their relative precedence/prominence, that is, I will use $\mathcal{T}_0$ for the theme with the highest precedence, $\mathcal{A}_0$ for the most prominent attentional intent, p_3 for a much less prominent attentional intent, and so on. Prominence Alignment then entails that rational speakers do not normally address the main theme $\mathcal{T}_0$ by means of, say, intent p_3. This notational convention will suffice for the purposes of this dissertation.

2.2 Content Efficacy

The purpose of expressing a certain content is to clearly convey a certain intent. Although the (informational) intents should ideally be true, there seems to be no reason why the same should hold for the contents, i.e., a false content may well serve to clearly convey a true intent, and the latter is all that matters. Indeed, I follow Recanati (2001) in assuming that the relation between the content of a sentence and the intent conveyed by means of it is not in general *inferential*. Rather, it must be, say, *associative*. (This contrasts with recent work in game-theoretical pragmatics (e.g., Franke 2009), according to which the relation would be inferential, bootstrapped by the assumption that a rational audience assumes that the speaker assumes that the audience assumes (etc.) that the semantic content itself is an intent. But motivation for the required assumption falls short; it is primarily a technical solution to a technical problem (*ibid.*, p.48), a problem which does not exist if we assume that the link is associative rather than inferential.)

To illustrate, let us consider the sorts of non-inferential relations between contents and intents that the maxim of Content Efficacy must ultimately account for. These include what Bach (1994) calls "(conversational) impliciture" (to be distinguished from Grice's "implic-a-ture"; see below). Bach distinguishes between "completion", which turns non-propositional contents into propositions,

and "expansion", which is the addition of further qualifications. Bach illustrates both with the following example (his (18)):

(2) a. Everybody is coming.
b. Everybody is coming [to my party]. *(completion of a.)*
c. Everybody [in my class] is coming [to my party] *(expansion of b.)*

According to Bach, (2c) explicates the sort of intent that may normally be in part implicitly conveyed by means of (2a). I refer to Bach for a wide range of examples of impliciture. Many similar and different examples are considered by Recanati (2004), who distinguishes several basic non-inferential relations (from p.23 onwards; the examples are his):

- Saturation: "She is smaller than John's sister" (e.g., she = Mary);
- Free enrichment: "He wears rabbit" (fur, not meat or live animal);
- Loosening: "The ATM swallowed my credit card" (not like an organism);
- Semantic transfer: "The ham sandwich left without paying" (the person who ordered it).

In each case, the purported intent of the utterance derives non-inferentially from the content of the uttered sentence. (Recanati calls the process of impliciture "explicature", which is a misnomer according to Bach (2010): "explicating" is what linguists do when analyzing an utterance, as in (2b,c), which is the opposite of what speakers do when leaving things implicit, as in (2a).)

The precise inventory of permissible relations between content and intent will not matter for current purposes. I will just assume that these relations are all cases of association, which is so vague as to be compatible with any more specific proposal (e.g., a proposal that only certain types of associations would matter or be permitted). A minimal constraint on the relation between contents and intents is that the first actually possible (and perhaps also sufficiently probable) intent that comes to the mind of the addressee, when presented with a semantic content, must be a genuine intent. To illustrate: in each of the examples given above the intent is arguably, though sometimes depending on the precise context, the first actually possible intent that comes to mind, the contents themselves being either incomplete, athematic, false or nonsensical. This minimal constraint is in line, for instance, with the central assumption in Relevance Theory (Sperber and Wilson, 1986b), setting aside certain differences in framework (cf. Bach 2010). In a framework closer to the current one, Roberts (2011) makes what seems to me an analogous assumption with regard to the interpretation of anaphora (her "Attentional Masking Hypothesis").

For a formal account of the relevant associations, the current formalism may have to be extended with a quantitative (numerical) component. I will not do so

at present, but for the sake of explicitness I will nevertheless pseudo-formalize the maxim of Content Efficacy. To that end I will adopt some new pseudo-formal notation, as well as refresh some old, actually formal notation:

(i) Let $*$ denote an "association strength" measure between contents and intents ($*$ must strictly speaking be a class of symbols that can apply to various types of contents and intents, cf. appendix A);

(ii) In line with mathematical usage, let the following denote the set of things that, when assigned to x, make φ true and maximize the value of α:

$$\underset{x:\varphi}{\text{argmax}}(\alpha)$$

(iii) Recall that $\diamondsuit$ means "possible given common knowledge";

(iv) Recall that $\mathbb{I}$ denotes the set of informational contents of an utterance, and $\mathcal{I}$ the set of informational intents. Likewise, we have a set $\mathscr{A}$ of attentional contents (a notion to be introduced in chapter 6) and a set $\mathscr{A}$ of attentional intents.

Content Efficacy can then be defined as follows, containing two analogous requirements for the informational and attentional side:

4.2. Definition. **Content Efficacy:**
An utterance complies with Content Efficacy iff for every (informational or attentional) content, the most closely associated intent that is a possible intent given common knowledge, must be an actual intent, i.e.:

$$\text{C-Efficacy} = \left(\begin{array}{l} \forall \mathbb{p}(\mathbb{I}(\mathbb{p}) \rightarrow \underset{p:\diamondsuit\mathcal{I}(p)}{\text{argmax}}(*(\mathbb{p}, p)) \subseteq \mathcal{I}) \wedge \\ \forall \mathbb{A}(\mathscr{A}(\mathbb{A}) \rightarrow \underset{\mathcal{A}:\diamondsuit\mathscr{A}(\mathcal{A})}{\text{argmax}}(*(\mathbb{A}, \mathcal{A})) \subseteq \mathscr{A}) \end{array} \right)$$

Or, as phrased in definition 4.1 earlier: the possible intents that are most directly associated with the contents must actually be intents. As I mentioned, this is intended to be a minimal constraint on the (necessarily non-inferential) link between contents and intents, that may in principle be refined in various ways. For present purposes it will be sufficient. On the informational side we can avoid most complexities by considering only what are arguably literal utterances, i.e., utterances where informational content and intent are simply equivalent. The attentional side, however, will be more interesting, as will become clear in chapter 6.

3 Direct and indirect intents

3.1 Two ways of achieving clarity

Content Efficacy may help achieve the requirements imposed by I/A-Clarity, i.e., that it must be common knowledge what the intents of an utterance are. If the addressee understands the semantic contents of the utterance, and if the association strengths are sufficiently shared, then it will be common knowledge what the first possible intents are that come to mind. If, in addition, compliance with Content Efficacy can be assumed, it will be common knowledge that these possible intents must be real intents, thus achieving I/A-Clarity. Let a *direct intent* be one that is communicated in this way. All attentional and informational intents that I have invoked thus far, e.g., in chapter 3, have implicitly been assumed to be direct intents – intuitively: they were quite explicitly expressed by the sentence uttered.

Only once a direct intent is recognized can an audience draw potentially interesting conclusions about the speaker's epistemic state and ultimately the world. Among these conclusions may be that the utterance has some other intent, on top of the direct intent. Let *indirect intents* be intents of this sort, i.e., intents that can be recognized only via inference on the basis of the prior recognition of a direct intent. To clarify: the communication of direct intents also involves inference, namely an inference from the assumption that Content Efficacy is complied with. What is non-inferential about the communication of direct intents is only the associative relation between content and intent on which this inference relies.

In the remainder of this subsection I will clarify the notions of direct and indirect intent, primarily by relating them to the literature. Subsequent subsections present two detailed illustrations of the distinction: indirect answers and exhaustivity implicatures.

The notions of direct and indirect intent are not new, and the terminology is not entirely new either. Grice's (1989, ch.2) *(conversational) implicatures* are indirect informational intents, and his notions of "what is said" and "conventional implicature", which for Grice were necessarily also part of "what is meant" (Neale 1992; Bach 2001), are types of direct informational intents. Davis (1998) calls indirect informational intents, i.e., implicatures, "indirect speaker meaning", and Searle (1975) calls indirect intents more generally (not just informational) "indirect speech acts". Relatedly, Levinson (1983) (and also Recanati) distinguish between "primary pragmatic processes", which take an audience from the recognition of sentence contents to the recognition of direct intents, and "secondary pragmatic processes", which may take an audience from the recognition of one intent to the recognition of another (where the relevant notion of process may well reside at the computational level of analysis, cf. chapter 1).

In the literature, definitions of something like the notion of implicature vary. For instance, Gazdar (1979, p.38) defines it as a proposition that is implied by the

utterance of a sentence but that is not an entailment of the sentence's content; Levinson (1983) defines it as an inference drawn by an audience; Gamut (1991, vol.1, p.207) define it as a logical consequence of "the conditions under which a sentence can correctly be used". As it happens, none of these captures the Gricean notion, i.e, the notion of indirect intent, because intents and implications/inferences are very different things. For instance, most utterances will imply that the speaker was breathing out while speaking, but this is not usually something which the speaker intended to convey. Vice versa, the existence of an intent does not necessarily imply its truth or even the speaker's belief in its truth, for instance because the maxim of I-Quality can in certain circumstances be suspended (see part II).

Of course this could be just a terminological quibble; these various notions called "implicature" are all worth studying. But the variation in definitions of implicature is arguably symptomatic of a number of persistent misconceptions in the field (cf. Bach 2006). For instance, Gazdar's definition seems to presuppose that entailments of a sentence's semantic content are always among the things implied by an utterance of a sentence, but that is not the case: the purpose of a content is to clearly convey an intent, and for this purpose the content itself need not be true (just as actual ham sandwiches need not be able to leave without paying); the link between content and intent (and implications) is not inferential. Levinson's definition may have contributed to the misconception that implicatures would be in some meaningful sense "weaker" than semantic entailments (see section 4), after all, inferences can be more or less certain – but the same may not hold for intentions. And each of these definitions including the one of Gamut may betray a more general underappreciation of the role of speaker intentions in an adequate theory of conversation.

The notion of indirect intent will be relied upon on various occasions throughout this dissertation. An important feature of indirect intents will be that they are less prominent than direct intents, in the sense of the submaxim of Prominence Alignment. I will make this assumption explicit:

4.3. Assumption. Indirect intents are less prominent than direct intents.

This implies that indirect intents will tend not to address the main theme. This is in line, for instance, with the assumption in Horn 2014 that conversational implicatures are *non-at-issue*. However, the latter term may be somewhat misleading in this case: indirect intents (unlike mere implications) must still address *some* theme, lest they would serve no purpose; what assumption 4.3 implies is merely that the theme addressed by an indirect intent will normally be one of lower precedence, i.e., a side theme. It is not necessarily incompatible, then, with the proposal in Destruel et al. 2015 that exhaustivity implicatures are at-issue

(see illustration 2 below), or with the assumption in Simons et al. 2010 that at-issueness is closed under negation (unlike the current themes, see chapter 5).

It does not follow from assumption 4.3 that indirect intents can *never* address the main theme, only that doing so would violate Prominence Alignment. Plausibly, speakers may do so for reasons of politeness, as captured by the Irony Principle of Leech:

> If you must cause offence, at least do so in a way which doesn't overtly conflict with the politeness principle, but allows the hearer to arrive at the offensive point of your remark indirectly, by way of implicature.
>
> (Leech 1983, (p.82))

A classical example of implicature seems to involve politeness in this way (or at least feigned politeness), namely Grice's (1989, ch.2) "Mr. X's command of English is excellent" as a negative recommendation. Something like assumption 4.3 seems to be necessary to explain why this is polite and arguably somewhat funny.

3.2 Illustration 1: Indirect answers

A typical case of implicature from the literature occurs with indirect answers (or "pragmatic answers", Groenendijk and Stokhof 1984), as in (3) and (4):

(3) A: Are you going to Paul's party?
B: I have to work. (implicature: I'm not going to the party.)

(4) *(It is commonly known that John always goes to parties if it is sunny.)*
A: Is John at the party?
B: It's sunny. (falling intonation; implicature: John is there.)

Example (3) is the opening example in the Stanford Encyclopedia of Philosophy article on implicature (Davis, 2014); (4) is constructed for present purposes. Below I will concentrate on (4), because it avoids certain complexities of (3). One complexity of (3) is that B resolves A's question negatively, which either raises the issue of why A did not draw attention to the negative state of affairs (cf. part II, chapter 12) or implies a thematic discontinuity (perhaps due to the Pruning Principle, chapter 2). Another complexity is that the purported implicature in (3) is permissive of two distinct analyses depending on the theme addressed by B: as an indirect answer, relying on the common knowledge that having to work prevents partying, or as a case of exhaustivity implicature (illustration 2 below), relying instead on A-Quantity.

Example (4) seems to me less natural than (3). One reason for this could be that it is difficult to imagine that the required common knowledge indeed obtains, i.e., that John's behavior is indeed so predictable – (3) requires merely

that we imagine that having to work prevents partying, which seems less difficult. Another reason might be that it is unclear why B would address A's question so indirectly (violating Prominence Alignment, as we will see) rather than just saying "yes"; Groenendijk and Stokhof (1984) already noted that indirect answers are dispreferred if a direct answer can be given. In contrast, in (3) politeness could plausibly explain why B gave an indirect answer, at least if A's question is interpreted as an invitation or suggestion.

If indeed (4) is as unnatural as it seems to me, we must be careful not to confuse it with more natural variants. One variant would have B merely provide some potential evidence, without her intending this to immediately resolve A's question – cases like this are natural with "rise-fall-rise" intonation, and will be discussed in chapter 11. Another variant that we must rule out has B nod prior to her utterance:

(5) B: *(nodding)* It's sunny.

In this case B is arguably not giving an indirect answer, but rather a direct answer, albeit gesturally, immediately followed by an explanation or motivation of that answer. The latter would address a theme plausibly evoked by some sort of "Explanation Principle", which would be in accordance with the rhetorical relation of "explanation" in the approach of Asher and Lascarides 2003. Compared to these more natural variants, (4B) must be imagined as being uttered with a bit of a pokerface. Unnatural as this may be, it will serve as a clear, minimal illustration of the notion of indirect intent. In what follows I will consider four possible analyses of (4B), where only the last one, which involves an indirect intent, will be satisfactory.

Analysis 1 Let us assign to B's response in (4) the informational content that it is sunny ($^\wedge S$), an equivalent informational intent (I will leave attention implicit), and a matching theme of, say, what the weather is like (sunny S, windy W, rainy R):

$$\mathbb{p}_0 = {}^\wedge S \qquad \boldsymbol{p}_0 = {}^\wedge S \qquad \mathcal{T}_0 = \{{}^\wedge S, {}^\wedge W, {}^\wedge R, \ldots\}$$

These assumptions may be oversimplified or even false in certain respects. For instance, it seems reasonable to assume that the intent $\boldsymbol{p}_0$ is in fact slightly more specific, e.g., that it is sunny *at a certain relevant location* – this would be a permissible case of impliciture. Moreover, the theme may well be quite different, e.g., what potential evidence there is or what the circumstances at the party are. But this will not matter for current purposes.

What matters is that the assumed main theme implies that the Continuity Principle is violated: presumably, the main theme underlying A's question is whether John was at the party. Perhaps, then, speaker B misheard or misinterpreted A's question. For instance, B might be thinking that A's inquiry about John is only

part of a strategy for finding out whether it is sunny, and since B knows that it is sunny, she cuts the strategy short. But if no such special circumstances apply, then the assumed content, intent and theme do not constitute a plausible analysis of (4B), for either an audience or a linguist.

Analysis 2 To avoid an unexplained violation of the Continuity Principle, let us change the assumed theme into one that was plausibly addressed by A's question:

$\mathbb{p}_0 = {\wedge}S \qquad p_0 = {\wedge}S \qquad \mathcal{T}_0 = \{{\wedge}Pj, {\wedge}\neg Pj\}$

Whether the theme really contains John's absence does not matter for current purposes. What matters is that the Continuity Principle can in principle be complied with. Unfortunately, relative to this main theme the utterance cannot comply with the maxims, for there is no intent that complies with I-Relation relative to it. Of course, this is a consequence of I-Relation being particularly strict in the current approach, more strict than, e.g., Relevance in Roberts 2012, a matter to which I will return further below.

Analysis 3. We can try to remedy this by changing the intent:

$\mathbb{p}_0 = {\wedge}S \qquad p_0 = {\wedge}Pj \qquad \mathcal{T}_0 = \{{\wedge}Pj, {\wedge}\neg Pj\}$

The Continuity Principle is still satisfied, and the intent complies with I-Relation relative to the theme. Unfortunately, it is unclear how it could comply with I-Clarity. Recall that the relation between content and (direct) intent is not inferential – the truth of the content is not given – but associative. Although there could be an association between it being sunny and John being present, B cannot rely on this as a form of impliciture, because other possible intents will come to the mind of an audience first. For all A knows, B may be addressing a weather-related theme in addition to A's original theme. Hence, nothing rules out that B's utterance is literal, i.e., that her intent is simply that it is sunny. (Note that any analysis lacking such an intent would fail to predict an implication for (4B) to the effect that B believes that it is sunny.)

Analysis 4. The problems for previous analyses can be overcome by combining them into one that has two themes and two intents:

$$\begin{array}{lll} \mathbb{p}_0 = {\wedge}S & p_0 = {\wedge}S & \mathcal{T}_1 = \{{\wedge}S, {\wedge}W, {\wedge}R, \ldots\} \\ & p_1 = {\wedge}Pj & \mathcal{T}_0 = \{{\wedge}Pj, {\wedge}\neg Pj\} \end{array}$$

Now, for both themes there is an intent that can in principle compliantly address it, the Continuity Principle is not violated, at least not as far as the main theme goes, and p_0 can comply with I-Clarity via Content Efficacy, in virtue of it being equivalent to the content, i.e., it is a direct intent. How the other intent p_1 complies with I-Clarity remains to be seen in detail, but we can already see that it can only be an indirect intent. As such, p_1 is less prominent, and because it addresses the main theme ($\mathcal{T}_0$) the utterance violates Prominence Alignment (as can be seen from the mismatching indices). Of course this calls for an explanation – perhaps B is testing A's wits, or perhaps she considers John's presence a taboo topic – but I will not pursue this further (the difficulty of finding a plausible explanation would explain why (4B) is, or at least seems to me, somewhat unnatural). Rather I will concentrate on how the purported indirect intent, p_1, can comply with I-Clarity.

Let us assume that the Continuity Principle is complied with as far as the main theme goes ($\mathcal{T}_0$) – this was motivated under analysis 1. Moreover, let us assume that the theme underlying A's question is completely clear to all participants, i.e., that thematic competence holds for all agents, at least with regard to $\mathcal{T}_0$. Furthermore, let us assume that the direct intent, p_0, complies with I-Clarity, i.e., that it is common knowledge that the proposition that it is sunny is an intent ($\boxdot(^\wedge S \in \mathcal{I})$). Now, compliance of the indirect intent p_1 with I-Clarity is achieved as follows:

1. Suppose that B takes her utterance to comply with the maxims;
2. Then B must believe that her intent that it is raining complies with I-Quality, i.e., she must believe that it is raining.
3. And then, given the common knowledge that John always attends sunny parties, B must believe that John is at the party;
4. From 1. it also follows that there must be an intent that compliantly addresses $\mathcal{T}_0$, and this can only be that John is present or that John is absent;
5. Given 3. and 4., the intent can only be that John is at the party;
6. If Compliance Transparency is complied with, then 1. and hence 5. will be common ground, hence the intent complies with I-Clarity.

To sum up, this proves the following:

4.4. Fact. For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (4B), with the assumed intents and themes of analysis 4, and thematic competence for $\boxdot$:

$$\mathbf{M}, w_0 \models \left(\begin{array}{c} \boxdot \Box \textsc{Maxims} \wedge \\ \boxdot(S \rightarrow Pj) \wedge \\ \text{I-}\textsc{Clarity}(p_0) \end{array} \right) \rightarrow \text{I-}\textsc{Clarity}(p_1)$$

Zooming out a little, the crucial two ingredients in the proof are that the speaker intends to compliantly address a particular theme ($\mathcal{T}_0$), hence there must be an intent, and that, of the various possible intents this leaves, only one turns out to be compatible with B's epistemic state.

Indirect intents and relevance

The proposed analysis of (4B) highlights that an intuitive notion of relevance does not necessarily correspond directly to the current rheme-pragmatic maxim of I-Relation. In (4B), the direct intent that it is sunny is, I take it, intuitively relevant to A's question. Nevertheless, in the current account, it is only the other, indirect intent that actually complies with I-Relation relative to the theme of A's question. The direct intent of (4B) is intuitively relevant not because it complies with I-Relation, but because it contextually entails the existence of an indirect intent that does, thereby enabling its clear communication.

This does not mean that contextual entailment has no role to play in some technical relevance-like notion – but the notion will be a theme-pragmatic one. That is, contextual entailment may help explain a speaker's choice to address a certain theme – for instance the weather-related theme of (4B), but also the "explanation" theme that was supposedly involved in the variant in (5), in which B nods prior to her response, and, as shown by Roberts 2012, *strategic* themes, which will be discussed in chapter 11.

Roberts does not distinguish theme-pragmatics from rheme-pragmatics, and aims to capture both indirect answers and strategies in a single notion of Relevance, defined in terms of contextual entailment. Since she invokes a notion of implicature as well, there is a redundancy in her treatment of indirect answers: they can be analyzed both with and without assuming an indirect intent, basically analyses 4 and 2 given above. To the extent that both analyses make the same predictions in Roberts's theory (whereas in the current theory they don't), the redundancy need not be harmful, except to the extent that it makes her theory more complex than necessary, and less determinate than possible.

3.3 Illustration 2: Exhaustivity implicature

Consider example (1) from chapter 3, repeated here:

(6) A: Who (of John, Mary and Bill) are at the party?
B: John is there. (with falling intonation)

Similar examples are often claimed in the literature to have an "exhaustivity implicature" (or "Quantity implicature", or "scalar implicature") to the effect that John was the only one $((\neg Pm \wedge \neg Pb))$, or, slightly weaker, that this is so according to B, or, even weaker, that the contrary is not so according to B. Although the term "implicature" is used in different senses, as I explained

earlier, at least on some occasions (e.g., Bach 2006) exhaustivity is conceived of as an implicature in the Gricean sense, i.e., an indirect intent. For the sake of illustration, I will assume that there is indeed such an indirect intent in (6), namely $^{\wedge}(\neg Pm \wedge \neg Pb)$, and try to explain why that should be so, and how it would comply with I-Clarity. To my awareness, no explanation of exhaustivity implicature in the Gricean sense currently exists – scholars tend to stop when the exhaustivity *implication* is accounted for.

I have already explained in detail how the exhaustivity *implication* arises that, according to B, John was the only one ($\Box(\neg Pm \wedge \neg Pb)$) – at least if the utterance may be taken to comply with the maxims. This simplifies the task ahead of us: if an utterance is predicted to imply something of the form $\Box\varphi$, then what we need in addition to predict or explain the existence of an indirect intent $^{\wedge}\varphi$, is merely a reason for the speaker to be addressing a theme containing it. For the sake of explicitness, and slightly more generally:

4.5. Assumption. If it is theme-pragmatically rational to address a certain theme, and if there is a proposition (or set of states of affairs) that would be rheme-pragmatically compliant as an informational (or attentional) intent, then this proposition (or set of states of affairs) will in fact be an intent.

In the case of (6), a possible reason for the inclusion of an indirect intent is provided by the Pruning Principle (chapter 2): for any piece of information p worth sharing with a certain precedence, the information $\overline{p}$ is also worth sharing, though, other things being equal, with lower precedence. Given this principle, though relying also on the Thematic Organization Principle to explain the particular organization of the available goals into themes, it may be defensible to assume the following themes and intents for (6) (again leaving attentional intents implicit):

$\mathbb{p}_0 = {}^{\wedge}Pj \quad p_0 = {}^{\wedge}Pj \qquad \mathcal{T}_0 = \{{}^{\wedge}Pj, {}^{\wedge}Pm, {}^{\wedge}Pb\}^{\cap}$
$\qquad\qquad p_1 = {}^{\wedge}(\neg Pm \wedge \neg Pb) \quad \mathcal{T}_1 = \{{}^{\wedge}\neg Pj, {}^{\wedge}\neg Pm, {}^{\wedge}\neg Pb\}^{\cap}$

Provided it will be common knowledge that a theme like $\mathcal{T}_1$ is being addressed, the exhaustivity implication and the clear communication of the direct intent p_0 will suffice to explain how the indirect intent p_1 can be clearly communicated (the details are analogous to example (4)).

The Pruning Principle predicts a difference in precedence between the two themes purportedly addressed by (6). Since direct intents are more prominent than indirect intents, this serves to explain, via the Prominence Alignment maxim, why it is rational for the speaker to address the theme evoked by the Pruning Principle $\mathcal{T}_1$ with an indirect intent. It also explains why negative responses to positive questions can be quite strange, as in (7), as noted for instance by Uegaki (2014):

(7) A: Who (of John, Mary and Bill) are at the party?
B: (?) Mary and Bill aren't there. (with falling intonation)

B's response in (7) could in principle have the same intents and themes as in (6), but in (7) the negative proposition would be a direct intent and the positive proposition (that John is there) an exhaustivity implicature. The latter predicts either a violation of Prominence Alignment, or a thematic reorganization (switching the precedence of the two themes), neither of which can be easily explained in this case. As Uegaki (2014) notes, (7B) improves with rise-fall-rise intonation, in which case it may be interpreted as a strategic, partial (non-exhaustive) answer ("...does that help?"). We will see examples of this in chapter 11.

The Pruning Principle may not be the only reason for addressing what is in some sense the complement of the main theme. For instance, in chapter 5 I will argue that if both the positive and the negative propositions are main-thematic to begin with, e.g., if someone asks "who was and who wasn't at the party?", it can be rational to reorganize those propositions into a positive and a negative theme in order to address one of them by means of an indirect intent. There, exhaustivity implicatures will play a crucial role in solving an empirical puzzle. For (6), in contrast, I have not shown what empirical difference the presence or absence of an exhaustivity implicature makes. Indeed, I do not think that the assumption of an exhaustivity implicature in (6), as opposed to merely an exhaustivity implication, is empirically necessary, at least not given the current theory. But to the extent that we are persuaded by the proposed explanation of its hypothetical presence, in terms of the Pruning Principle, we may be forced to assume its actual presence.

Exhaustivity *impliciture*?

In chapter 3 exhaustivity implications were accounted for in terms of the prior recognition of a direct intent and its compliance with the maxims. Accordingly, in the foregoing I explained exhaustivity as an indirect intent, i.e., a case of implicature. But couldn't it be a direct intent? That is to say, perhaps our assumption that (6) has a direct intent to the effect that John is at the party (^Pj) has been wrong all along; rather, we should have assumed an exhaustive direct intent ($^(Pj \wedge \neg Pm \wedge \neg Pb)$), and accounted for the discrepancy between intent and content as a case of *impliciture*, rather than implicature. The situation could be as follows:

(8) B: John is at the party.

$\mathbb{p}_0 = {}^Pj \qquad \boldsymbol{p}_0 = {}^(Pj \wedge \neg Pm \wedge \neg Pb)$ (hypothetical)
$\mathcal{T}_0 = \{{}^Pj, {}^Pm, {}^Pb, {}^\neg Pj, {}^\neg Pm, {}^\neg Pb\}^\cap$

The theme has been adjusted accordingly, so that the informational intent can comply with the maxims (though other themes are possible too, e.g., a *partition*; Groenendijk and Stokhof 1984). Superficially, the "symmetrical" theme is not altogether implausible, and the relation between content and intent looks like a reasonably innocent case of expansion, paraphrasable by adding "...and no one else", or even just "only ...":

(9) a. John is at the party.
b. John is at the party and no one else.
c. Only John is at the party.

Moreover, given the assumed intent, the exhaustivity *implication* can be accounted for simply in terms of its compliance with I-Quality – attentional intents do not even enter the picture.

I am unaware of explicit versions of this impliciture-based approach to exhaustivity in the literature. It does share with the "grammatical approach" to exhaustivity (e.g., Chierchia, Fox, and Spector, 2012) the feature that exhaustivity is considered part of the direct intent – but grammaticalists go one step further by assuming that it is also part of the semantic content. Here I will concentrate on a purely hypothetical treatment of exhaustivity as an impliciture – I will call it the "associative approach" – and highlight four challenges it faces. This discussion will serve both to clarify the distinction between implicature and impliciture, and to retroactively motivate the inferential approach to exhaustivity pursued in chapter 3.

First, the associative approach will, at least without further assumptions, work only for cases in which the theme is symmetrical, in the sense that, for (8), it pertains to both absence and presence. (In contrast, the explanation of exhaustivity *implicature* proposed above, in terms of the Pruning Principle, depends on an asymmetry.) In light of the literature on negation (for an overview see Horn 2001), in which it is noted that there are pervasive asymmetries between the relevance of positive and negative propositions, this would severely limit the empirical scope of the associative account. Although it has occasionally been assumed that relevance is fundamentally symmetrical (e.g., Chierchia, Fox, and Spector 2012), motivations for this assumption fall short, as I will explain in chapter 5.

Second, the purported case of impliciture, i.e., from (9a) to something paraphrasable by (9b) or perhaps (9c), may not be so innocent, at least if we assume with Bach (1994) that impliciture is a semantic process. It requires that we associate John's presence at the party with Mary's and Bill's absence. This may of course happen, in the long run, but Mary's and Bill's absence share with John's presence neither the individual nor the property attributed to it.

Third, the associative approach has to explain why John's presence would be associated with Mary's absence rather than (or sooner than) Mary's presence. After all, it has to explain why (9a) would be understood as (9b,c) rather than (10a) or (10b):

(10) a. John is at the party, and so is everyone else.
b. John and Mary are at the party but not Bill.

The problem is that, given the symmetrical type of theme that the associative approach must assume, all of (9b,c) and (10a,b) express possible intents. This is an instance of the well-known *symmetry problem*, to be discussed in chapter 5, where I will argue that existing solutions are not satisfactory – and the new solution I will propose consists essentially in avoiding symmetrical themes (and explaining why that would be rational).

Fourth, if there is any rheme-pragmatic or theme-pragmatic possibility at all that (8) is being used with a *literal* direct intent (^Pj), the associative approach arguably fails, because the literal intent will come to mind first. In order to rule out the literal use, one might try to change the assumed theme so that it contains only the complete, exhaustive answers (e.g., $^(Pj \wedge Pb \wedge \neg Pm)$), i.e., the theme would be a *partition* (cf. Groenendijk and Stokhof 1984). But this alone is insufficient: we must also rule out certain thematic discontinuities, in order to prevent B from shifting to a theme that does include John's plain presence, e.g., she could decide to close the theme under unions even if it originally wasn't. One might be tempted, then, to stipulate that all themes are necessarily partitions, but motivations in the literature for this assumption fall short (see chapter 5). Moreover, one would not in general want to rule out that partial answers may be given. In contrast, compare how easy it is, for most or all examples of genuine impliciture from the literature given earlier ("The ham sandwich...", etc.), to explain why the relevant utterance could not have been used literally.

It is impossible to prove at this point, without a detailed account of associations, that the associative approach to exhaustivity cannot be made to work somehow. But I hope to have shown in part, and to continue to show in chapter 5, that any such implementation would have to rely on several non-trivial and potentially problematic assumptions. More generally, the associative link is arguably the weakest link in communication – unlike inference it need not respect truth – so rational speakers may tend to keep it short. I conclude that exhaustivity, if it is an intent at all, is most probably an indirect intent, i.e., communicated by implicature, not impliciture. This retroactively motivates the account of exhaustivity implications presented in chapter 3.

4 Implicatures vs. entailments

The foregoing sections have served to clarify the notions of content, direct intent and indirect intent, and thereby the relation between *semantic entailments* (i.e., logical consequences of the truth of the semantic content) and *(conversational) implicatures*, i.e., indirect intents. In this short section I will address one common

misconception regarding the latter that may nevertheless remain, namely that implicatures (and/or pragmatic implications) would be "weaker", in some sense, than semantic entailments. This misconception may stem from Grice's (1989, ch.2, p.39) proposal that implicatures are "cancelable", i.e., that, since implicatures (indirect intents) rely for their clear communication on various contextual assumptions, they may seem to appear and disappear if the same sentence is uttered in different contexts. While I do not dispute Grice's proposal, it has arguably been misunderstood.

It is sometimes thought that cancelability implies that one can utter something, with a certain indirect intent, and subsequently happily contradict it, without any sort of change of mind. This would certainly be puzzling behavior for a rational speaker, as I-Quality would have to be violated by one intent or the other. As Roberts (2012, p.46) notes, the idea that implicatures could be canceled in this sense is a misconception. It is reinforced by classical examples of implicature cancelation (e.g., "but I did not mean to imply..."), which are often misconstrued as cases of implicating something and then contradicting it, but which in fact involve, as Roberts calls it (p.45–46), "post-hoc clarification of intended context" (Roberts refers to Welker 1994 for a similar diagnosis).

A closely related misconception is that pragmatic *implications* would be intrinsically weaker than semantic entailments; for instance, pragmatic implications would be *defeasible* (e.g., Schulz and Van Rooij, 2006; Geurts, 2011, among many). There is no reason why that should be so. A semantic entailment is a logical consequence of the semantic content's being true, and a pragmatic implication is a logical consequence of an utterance having been made by a rational speaker. The premises are different, but in both cases the relation is logical consequence.

One might object that pragmatic implications are still intrinsically weaker in the sense that the required premises are often more uncertain than in the case of semantic entailments. But this claim is simply false: it will generally be safer to assume that an utterance is made by a rational speaker than that it is made by a *literal-minded expert*. It is, then, the semantic entailment that is "weaker" in the (misleading) sense of relying on an uncertain, typically unwarranted assumption; pragmatic implications will often go through when semantic entailments don't. The key to this easy rebuttal is assumption 1.3 in chapter 1, that sentences as such do not really imply/entail anything except by virtue of them having been uttered by a rational speaker. (Lauer 2013, ch.9, likewise acknowledges that semantic entailments can only affect an agent's belief state via pragmatics; he relates this to the notion of "mandatory implicature".)

Perhaps what is meant when pragmatic implications are called "weaker" is that *intuitions about* semantic entailments, regardless of whether the sentence is assumed to be true, are more robust than *intuitions about* pragmatic implications (and about indirect intents). However, this rendering presupposes that we have direct intuitive access to semantic contents, which is questionable given that it is a theory-internal notion (cf. chapter 2). Moreover, it seems to mistake the

researcher's uncertainty about a certain phenomenon for the purported flimsiness of the phenomenon itself – perhaps this is a case of treating intuitions themselves as the primary phenomenon of investigation, rather than what these intuitions are arguably about (cf. chapter 1).

From the current perspective, the only way to make sense of the claim that pragmatic implications are "weaker" than semantic entailments is as a theory-internal, methodological heuristic: (reports of) speaker intuitions may be more or less robust, and non-robustness ("weakness") could be a first indication that an appropriate explanation may perhaps be construed that relies primarily on features of the context rather than linguistic conventions (i.e., semantic content). It seems to me that this is how Grice understood his cancelability diagnostic:

> Indeed I very much doubt whether the features mentioned [e.g., cancelability] can be made to provide any such knock-down test, though I am sure that at least some of them are useful as providing a more or less strong prima facie case in favor of the presence of a conversational implicature. But I would say that any such case would at least have to be supported by a demonstration of the way in which what is putatively implicated could have come to be implicated (by a derivation of it from conversational principles and other data); [...].
>
> (Grice 1989, ch.3, p.43)

Whether something is a pragmatic implication or a semantic entailment, and whether something is a content, direct intent or indirect intent, is determined by the adequacy of the resulting explanation in the theory as a whole. Non-robustness of our intuitions may invite us to check certain explanations first, but this does not imply that indirect intents or pragmatic implications are "weak" in any way.

Conceptual clarity is of course important in general; but the erroneous supposition that implicatures and/or pragmatic implications are "weak" is particularly harmful: if a phenomenon is misunderstood as being intrinsically flimsy, this discourages closer inspection and makes the development of a rigorous, formal and testable theory seem futile. (I encountered such pessimism in reviews of my work.) Moreover, the accompanying supposition that semantic entailments are somehow "strong" may prevent a clean separation between ordinary language philosophy and a scientific theory of conversation (cf. chapter 1).

5 Conclusion and outlook

This chapter aimed to clarify the notions of content and intent. To that end a partial maxim of Manner was defined, with submaxims of Clarity (Content Efficacy, Compliance Transparency), Conciseness and Orderliness (Prominence

Alignment). None of these submaxims was really new, but they are not often made explicit all in one place. The maxim of Manner completes the set of maxims of Attentional Pragmatics, as far as this dissertation goes.

The Content Efficacy submaxim enabled us to distinguish the notions of direct intent and indirect intent (implicature), where the former relies for its communication primarily on that maxim. I illustrated the distinction by considering indirect answers and exhaustivity implicatures. The former served also to explain why the maxims of I/A-Relation need not allow for indirect answers. Lastly, I addressed some misconceptions surrounding the notion of implicature cancelability that can hardly arise if the elementary distinctions between content, intent, implication, and intuition are kept in mind.

Subsequent chapters will build on the current chapter mainly in the following respects:

- Chapter 5: the notion of indirect intent, and exhaustivity implicature in particular, will play a central role in solving the *symmetry problem*; existing approaches based on Conciseness will be shown to fall short.

- Chapter 6: Content Efficacy and Conciseness will help to explain how attentional intents are conveyed, and to motivate the attentional intents assumed thus far.

- Part II: the intonational means on which speakers rely for achieving Compliance Transparency, as required by Manner, will be explored in depth.

Chapter 5

(Dis)solving the symmetry problem

1 Introduction

Consider again example (1) from chapter 3:

(1) A: Who (of John, Mary and Bill) are at the party?
B: John is there.

$p_0 = {}^\wedge Pj \qquad \mathcal{A}_0 = \{{}^\wedge Pj\} \qquad$ a. $\mathcal{T}_0 = \{{}^\wedge Pj, {}^\wedge Pm, {}^\wedge Pb\}^\cap$

The theme of B's response (and A's question) has thus far been assumed to be "positive", i.e., contain only people's presences (and their intersections), not their absences. It is not immediately obvious that this assumption is justified. Someone who is interested in who is present, may well be interested also in who is absent, suggesting, perhaps, the following "symmetrical" theme instead:

b. $\mathcal{T}_0 = \{{}^\wedge Pj, {}^\wedge Pm, {}^\wedge Pb, {}^\wedge\neg Pj, {}^\wedge\neg Pm, {}^\wedge\neg Pb\}^\cap$

Or perhaps the questioner is interested only in a complete answer, in which case the following "partition" theme could be justified:

c. $\mathcal{T}_0 = \{{}^\wedge Pjmb, {}^\wedge(Pjm \wedge \neg Pb), {}^\wedge(Pjb \wedge \neg Pm), {}^\wedge(Pj \wedge \neg Pm \wedge \neg Pb), \ldots\}$

This is a partition on the set of worlds, each partition cell corresponding to an exhaustive answer.

Although the themes of options b. and c. may not seem unreasonable, both would prevent a pragmatic derivation of exhaustivity. For instance, although compliance of B's informational intent (${}^\wedge Pj$) with I-Quantity will, relative to either theme, correctly imply that B must not believe that Mary or Bill is *present* ($\neg\Box Pm$, $\neg\Box Pb$), it will also imply that B does not believe that they are *absent* ($\neg\Box\neg Pm$, $\neg\Box\neg Pb$) – or else she would have said so. And the latter directly

contradicts the exhaustivity implication that we would want to derive for (1). Formally:

5.1. Fact. For all normal pragmatic utterance models for (1B) that validate thematic competence, with $\mathcal{T}_0$ as in option b. or c. above:

$$\mathbf{M}, w_0 \models \Box \text{I-Quantity}(p_0, \mathcal{T}_0) \rightarrow \neg\Box\neg Pm$$

the consequent of which contradicts $\Box\neg Pm$. (Likewise for Bill.)

In this way, symmetrical themes and partitions prevent exhaustivity; and they do so regardless of how we were planning to derive it, e.g., through I-Quantity or through A-Quantity.

This situation is commonly called the "symmetry problem" (attributed to MIT course notes of Heim and von Fintel), and I will adopt the same term. Something like the symmetry problem was first pointed out, in relation to accounts of exhaustivity based on I-Quantity, by Kroch (1972), subsequently by Groenendijk and Stokhof (1984), among others, and more recently by, e.g., Katzir (2007), Block (2008), and Chierchia, Fox, and Spector (2012). Groenendijk and Stokhof write:

> If we consider two answers a and a', where a' is the exhaustive variant of a, it will be clear that, if both meet the requirements of Relation and Quality, the exhaustive a' will be preferred by Quantity over the non-exhaustive a. So, we see that instead of providing non-exhaustive answers with an exhaustivity implicature, Quantity rather does the opposite. It prefers exhaustive answers over non-exhaustive ones, and consequently a non-exhaustive answer will pragmatically imply the negation of exhaustivity.
>
> (Groenendijk and Stokhof 1984, p.371)

What exactly makes this situation a problem can be understood in two ways, the first of which appears to be more common:

- **Foundational:** Themes are necessarily symmetrical (or partitions, henceforth omitted).
- **Empirical:** Themes are sometimes symmetrical in cases where exhaustivity is implied.

As a *foundational* problem, say, one that reflects some deep fact about the way speakers organize their goals, it would be a problem for Attentional Pragmatics and existing accounts of exhaustivity alike. Some additional filter on themes would have to be assumed to explain why only the positive states of affairs seem to matter for deriving exhaustivity. In existing accounts, based on I-Quantity, two

filters that have been employed to this end are the maxim of Manner-Conciseness and "Horn scales", but neither is entirely satisfactory, as I will argue towards the end of this chapter.

As a non-foundational, *empirical* problem, it really depends on the empirical facts whether the symmetry problem even exists. Example (1) may not make a particularly strong case for the theme's being symmetrical. Potentially more problematic is the following, where A's initiative is explicitly symmetrical:

(2) A: I need to know for all five people on this list (John, Mary, Bill, Sue, and Chris) whether they were present or absent.
B: John was present, and Bill was present.
A: Wow, only two, what a disappointment!

If B's response ends with a falling pitch, A's subsequent conclusion seems to me warranted. This, then, may be a context in which the theme introduced by A is really symmetrical or a partition, hence in which a naive application of the Continuity Principle would predict the same theme for B, yet in which B's utterance implies exhaustivity nevertheless.

One way to explain the exhaustivity implication in (2) is to dispute that B's utterance addresses the symmetrical theme or partition that supposedly underlies A's initiative at all, i.e., to argue that our naive application of the Continuity Principle was unjustified. Within existing accounts, based on I-Quantity, such an appeal to a thematic discontinuity might have been ad hoc (at least without taking other matters into account, such as intonation, and in particular the lack of accents on "present"; cf. part II). This is because B's informational intent may well comply with the I-maxims relative to a symmetrical theme (though not relative to the partition unless I-Relation is weakened to permit partial answers). In contrast, Attentional Pragmatics *predicts* a discontinuity, because there is no way for B's attentional intent ($\{^\wedge Pjb\}$) to comply with the A-maxims relative to the symmetrical theme or the partition. Formally:

5.2. Fact. For all normal pragmatic utterance models for (2B) that validate thematic competence, where we assume that $\mathcal{A}_0 = \{^\wedge Pjb\}$ and the theme $\mathcal{T}_0$ is like option b. or c. given earlier (extended with Sue and Chris):

$$\mathbf{M}, w_0 \models \Box\neg \text{ A-Quantity}(\mathcal{A}_0, \mathcal{T}_0)$$

For a symmetrical theme, this holds because B necessarily considers either Mary's presence or Mary's absence possible, but the attentional intent contains neither. Similarly for a partition theme: B must consider at least one complete answer possible, but she draws attention to none.

In sum, Attentional Pragmatics *predicts* that (2) involves a thematic discontinuity; it is not an ad hoc assumption that serves only to avoid the symmetry problem. (The same would hold for any account of exhaustivity that, given

a symmetrical theme, would predict contradictory exhaustivity implications; it *doesn't* work for accounts based on exhaustivity "operators" that are defined so as to avoid contradictions, e.g., innocent exclusion (Fox, 2007); cf. Gajewski 2012.) Within this approach, then, the symmetry problem as an empirical problem is only apparent and should be rephrased:

- **Empirical (version 2):** A naive and (according to Attentional Pragmatics) unwarranted application of the Continuity Principle sometimes predicts a symmetrical theme in cases where exhaustivity is implied.

This is not necessarily a serious problem, but rather a research question: in what way was our application of the Continuity Principle in (2) too naive, i.e., which interfering theme-pragmatic principle did we overlook?

The main aims of the present chapter are to dispute that the symmetry problem is a foundational problem, and to solve it as an empirical problem (version 2) by explaining the thematic discontinuity. This will be done in sections 2 and 3, respectively. In section 4 I will argue that two existing approaches to the symmetry problem, based on considerations of conciseness and based on "Horn scales", are unsatisfactory. Section 5 concludes.

2 A foundational symmetry problem?

Chierchia, Fox, and Spector conceive of the symmetry problem as a foundational problem:

> Let us grant that in uttering ["Joe or Bill will show up"], ["Joe and Bill will show up"] is also indeed relevant, whatever 'relevant' may mean. Now, a natural assumption is that the property of 'being relevant' is closed under negation, i.e. if a proposition φ is relevant, then $\neg\varphi$ is relevant as well. To say that φ is relevant must be to say that it matters whether φ is true or false.
>
> (Chierchia, Fox, and Spector, 2012)

Later they call closure under negation a "minimal and hard to avoid assumption on relevance". They motivate this by an appeal to intuition, and (in a footnote) an appeal to Carnap 1950 and Groenendijk and Stokhof 1984 for two existing notions of relevance that, indeed, have this closure property (or something much like it). Other authors motivate the purported symmetry of relevance in a similar fashion (e.g., Fox and Katzir (2011) cite Lewis 1988 for a view much in line with Carnap), or simply take it for granted (e.g., Block 2008). I will first discuss the existing notions of relevance cited by Chierchia et al., and then their appeal to intuition.

Carnap (1950) assumes that a piece of information is relevant to a hypothesis if adding it to one's knowledge base increases or decreases the probability of that hypothesis, and he proves that a piece of information and its negation will shift the probability in opposite ways, but in equal amounts. The equal amounts notwithstanding, Carnap does distinguish positive relevance (increasing the probability) from negative relevance (decreasing it), a distinction to which pragmatics may in principle be sensitive, but which Chierchia et al. seem to ignore. Regardless, Carnap's notion of relevance is motivated from the perspective of an agent interested in whether a hypothesis is true or false, and it need not be the case that conversational participants are like that. Perhaps conversational participants can care a lot about some information being true, while caring much less about that same information being false. (The same criticism applies to Lewis 1988.)

Groenendijk and Stokhof, 1984 define a notion of relevance in terms of answerhood to questions, which they analyze as partitions: sets of complete, exhaustive answers. While a partition itself is not generally closed under negation, it *is* once taken together with all partial answers (and we have already seen that it gives rise to a symmetry problem regardless, as was noted by Groenendijk and Stokhof themselves). Based on Groenendijk and Stokhof's partition theory, Chierchia et al. claim that defining relevance in terms of answerhood in general commits one to symmetry or closure under negation. However, this is the case only if we restrict ourselves to *exhaustive* answers, which is what partitions happen to capture. Groenendijk and Stokhof themselves argue independently (p.528 and onwards) that it is necessary to distinguish positive answers from other (in their terminology) partial answers, namely for an account of "mention-some" uses of questions. Moreover, different theories of questions exist that do not have this property, also theories that satisfy Groenendijk and Stokhof's logico-philosophical desiderata (e.g., Ciardelli, Groenendijk, and Roelofsen 2013; for discussion see Ciardelli 2014). Furthermore, although one would certainly expect an intimate relation between questions (as utterances, or as contents of interrogatives) and conversational goals, the relation is indirect, mediated by pragmatics (see chapter 6), so we must not jump from conclusions about the one to conclusions about the other.

What remains is Chierchia et al.'s appeal to intuition. Although intuition should not ultimately be considered decisive (cf. chapter 1), in this stage of theorizing it cannot be too easily ignored either. In this case, my intuition happens to disagree with theirs. Consider the following example:

(3) *(B sees A confidently leaving the house without an umbrella.)*
   a. B: It's going to rain.
   b. (?) B: It will stay dry.

It seems to me that A should be grateful for (3a) and rather puzzled by (3b). B's utterance in (3b) seems to me unhelpful, not worth making, and, I would say,

irrelevant. Even if Chierchia et al. may disagree with my use of the English word "relevant" here (but perhaps they would not), it seems to me hard to deny that there is some contrast between B's utterances in (3) that may be of pragmatic interest, that one could safely assume a theory of goals to be sensitive to, and that hence could find its way into a technical notion of relevance or theme.

In fact, Chierchia et al.'s position finds an adversary in what Horn (2001) calls the "asymmetry thesis", that we tend to be interested mainly in what there is, and much less in what there isn't (Horn 1978). This would be apparent, for instance, in the fact that positive and negative sentences seem to serve different purposes in conversation:

> There should be a reason to utter a sentence and, for a negative sentence, that reason [...] is generally the earlier consideration of its contained affirmative counterpart.
>
> (Horn 1978, p.203)

If the asymmetry thesis is right, then the symmetry problem is not a foundational problem: our interests would be fundamentally asymmetrical. I will briefly consider why that may be so.

Leech tries to explain the asymmetry as follows (see also Givón 1978):

> Negative propositions are generally far less informative than positive ones, simply because the population of negative facts in the world is far greater than that of positive facts.
>
> (Leech 1981, p.431)

For instance, there are many more cities that *aren't* the capital of Peru, than cities that *are* – hence, for any given city, unless the context is particularly biased in favor of that city being the capital of Peru, it would not be worth mentioning that it isn't. This seems to me a plausible generalization, but it doesn't suffice as an explanation. The reason is that it presupposes a distinction between positive facts and negative facts that is prior to language use, and hence prior to the distinction between positive and negative (negated) sentences, and it is unclear to me how such a distinction could be adequately drawn. Arguably, the reason why Bogotá's not being the capital of Peru "feels" negative is that we can only express it using a negation, and the reason for that is that non-capitalhood has proven to be so uninteresting throughout the history of our language that no separate lexical entry for it has ever caught on. In this respect, the purported asymmetry in our interests must be prior to the distinction between positive and negative facts/propositions.

I think that a more promising line of explanation will involve the distinction between *defaults* and *exceptions* – a central topic in cognitive science, artificial

intelligence, and other fields. In order to make plans in an uncertain world, we rely on default assumptions, e.g., that our bike will not have a flat tire, that our interlocutors will be rational, and that gravity will not suddenly change direction. Any default assumption we make will arguably give rise to an asymmetry in our interests: only the complements of the contents of our default assumptions will necessitate a change in plans and hence be worth sharing. This type of explanation for the purported asymmetry of our interests draws the causal arrow in the right direction, unlike Leech's proposal. Now, this is only a suggestion, and for present purposes it is unnecessary to pursue this further. The point of the foregoing was that there is no reason to think of the symmetry problem as a foundational problem.

3 Solving the empirical symmetry problem

Recall from the introduction to this chapter that the symmetry problem as a genuine empirical problem may not exist, i.e., that, at least given Attentional Pragmatics, exhaustivity does not genuinely occur on utterances that address a symmetrical theme. The reason is that the types of utterances that imply exhaustivity cannot compliantly address symmetrical themes to begin with, hence any exhaustivity-implying response to an explicitly symmetrical initiative must involve a thematic discontinuity. The relevant sort of example is (2) above, repeated here with the main themes I assume:

(2) A: I need to know for all five people on this list (John, Mary, Bill, Sue, and Chris) whether they were present or absent.

$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb, \ldots, ^\wedge\neg Pj, ^\wedge\neg Pm, ^\wedge\neg Pb, \ldots\}^\cap$

B: John was present, and Bill was present.

$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb, ^\wedge Ps, ^\wedge Pc\}^\cap$

A: Wow, only two, what a disappointment!

The only "symmetry problem" that remains is more like a research question: which theme-pragmatic principle is responsible for the predicted discontinuity in examples like (2)? Put differently, why would a rational speaker address an asymmetrical theme despite symmetrical interests? (This line of explanation is unavailable if one assumes that the symmetry problem is a foundational problem: there would be no asymmetrical theme by which to replace the symmetrical one.)

I assume that the Thematic Organization Principle is responsible, i.e., that for some reason speaker B decided to split the symmetrical theme into a positive one and a negative one, and to address one of the two by means of an indirect intent. That is, I assume the following themes and intents for B's response:

(4) B: John was present, and Bill was present.

$\mathcal{T}_0 = \{^Pj, ^Pm, ^Pb, \ldots\}^\cap$ $\quad \mathcal{T}_1 = \{^\neg Pj, ^\neg Pm, ^\neg Pb, \ldots\}^\cap$
$p_0 = ^(Pj \wedge Pb)$ $\quad p_1 = ^(\neg Pm \wedge \neg Ps \wedge \neg Pc)$
$\mathcal{A}_0 = \{^(Pj \wedge Pb)\}$ $\quad \mathcal{A}_1 = \{^(\neg Pm \wedge \neg Ps \wedge \neg Pc)\}$

This utterance can comply with the maxims: for each theme, there are appropriate intents, and the indirect intents can presumably be clearly communicated by means of the exhaustivity implication, a situation covered in chapter 4. Moreover, splitting the theme in two parts ought to be a legitimate move in principle: all the basic goals of the original theme (of A's initiative) are still there – they have merely been reorganized. The same type of reorganization is assumed by Roberts (2012), and captured in her notion of *strategy*. The question that remains to be addressed is what is gained by this reorganization, compared to either leaving the original theme intact or shuffling the goals in various other ways.

One advantage of splitting up the theme and addressing one half implicitly is that it permits shorter, simpler utterances. Compared to (4), an equally explicit response to the symmetrical theme would have looked as follows:

(5) B: John was present, Bill was present, Mary was absent, Sue was absent, and Chris was absent.

Of course this can be put more concisely as (6a), but so can B's response in (5), namely as (6b):

(6) a. B: John and Bill were there, and Mary, Sue and Chris were not.
b. B: John and Bill were there.

At the very least, then, B's theme-pragmatic maneuver favors conciseness, and considerably so.

It may be objected that perhaps (6a) can be further shortened to:

(7) Only John and Bill were there.

which is only one word longer than (6b). However, many have disputed that (7) would be informationally equivalent to (6a), for instance in light of the (marginal) acceptability, to most speakers, of sentences like the following (a type of case Horn (2009) traces back to Horn 1969):

(8) Only John will come, and perhaps even he won't.

Indeed, Van Rooij and Schulz (2007) and Ippolito (2008) argue that the positive part of the answer provided by (7) is a conversational implicature, which would in the current framework call for a two-themed analysis just like (4), but one in which the theme that is explicitly addressed is the negative one (which is of course possible). Others have argued that the positive part of the answer provided by (8) would be *presupposed* (say, implied to be common ground) or *conventionally*

implicated (in current terminology: a direct intent with non-maximal prominence, likewise calling for a two-theme analysis). See Horn 2009 for a recent case in favor of the latter, and for a recent overview of what he calls the "asymmetry wars" surrounding "only". In light of this, the relevant conciseness comparison to be made seems to be between (6a) and (6b), according to which the benefit of B's theme-pragmatic maneuver is substantial.

While conciseness alone may give us a reason why B chose to split the prior theme into two, it does not explain why it should be split into a positive theme and a negative theme, as assumed in (4), rather than, e.g.:

$$\mathcal{T}_0 = \{\ ^\wedge Pj, ^\wedge\neg Pm,\ ^\wedge Pb, ^\wedge\neg Ps,\ ^\wedge Pc\}^\cap$$
$$\mathcal{T}_1 = \{^\wedge\neg Pj,\ ^\wedge Pm, ^\wedge\neg Pb,\ ^\wedge Ps, ^\wedge\neg Pc\}^\cap$$

After all, this split would have offered the same benefit of conciseness: relative to $\mathcal{T}_0$, B's utterance would have implied that Mary and Sue were present, and that Chris was absent, and this implication could have served to address $\mathcal{T}_1$ with an indirect intent. I assume that the reason why this split is dispreferred by the Thematic Organization Principle is that the themes are more complex: the states of affairs in each theme in (4) vary only along a single dimension, i.e., the individual, whereas the states of affairs in the above themes vary along two dimensions: the individual, and whether they are absent or present – and they vary in a rather unpredictable way, because not every combination of individual and absence/presence is thematic. (This presupposes that the states of affairs of John being present ($^\wedge Pj$) and Mary being present ($^\wedge Pm$) have something pre-linguistic, say, cognitive, in common that John being present ($^\wedge Pj$) and Mary being *absent* ($^\wedge\neg Pm$) lack.)

This added complexity may in turn compromise *clarity*: it will be difficult to clearly convey (cf. chapter 4) which asymmetrical themes with two dimensions of variation, out of many, are the ones being addressed. For instance, any asymmetrical, two-dimensional main theme would presumably require the same accentuation (cf. part II on intonation), with accents both on "John/Bill" and on "present", whereas in (4) the nature of the main theme can be transparently indicated by an accent only on "John/Bill". Furthermore, the choice of themes in (4) may also favor clarity by establishing a mapping between "being present" and "being mentioned", which, it seems to me, may facilitate comprehension and decrease attentional load – but I will leave this as a mere suggestion.

Lastly, the fact that these irregular asymmetrical themes are dispreferred explains why the following variant appears not to imply any sort of exhaustivity with regard to Mary, Sue or Chris:

(9) B: John was there, and Bill wasn't.

Rather than imply exhaustivity, this utterance seems (to me) to leave open the question of whether the other individuals were present or not. Without here

wishing to motivate any particular analysis of (9): the current account favors an analysis according to which (9) addresses a symmetrical theme, but a symmetrical theme that pertains only to John and Bill, potentially as part of a strategy for addressing a wider symmetrical theme, say, the one that pertains also to Mary, Sue and Chris. Strategies of this sort will be discussed in part II, chapter 11, and linked (albeit not exclusively) to rise-fall-rise intonation, which seems to me quite natural in (9).

In sum, the thematic discontinuity that Attentional Pragmatics predicts for examples like (2) is accounted for by the Thematic Organization Principle: the prior, symmetrical theme is reorganized in a way that favors conciseness, simplicity and clarity. In a sense the empirical symmetry problem solves itself: speakers address asymmetrical themes precisely because symmetrical themes prevent them from using exhaustivity implications to convey part of the answer. Of course, the benefits offered by exhaustivity implicature are circumstantial. For instance, if speaker A is ticking boxes on a checklist of individuals, it would be better for B not to split up the theme, but to address it as it is, and in the precise order of the checklist:

(10) B: John was there, Mary wasn't, Bill was, and Sue and Chris weren't.

Moreover, addressing the negative theme implicitly may not be a good idea in cases where the domain of relevant individuals is not entirely clear (i.e., thematic competence doesn't hold), as that could compromise the clear communication of the exhaustivity implicature. But otherwise B's decision in (2), to split up the theme into a positive and a negative part, seems to be perfectly rational.

4 Other approaches

4.1 Approaches based on Manner-Conciseness

If one believes that the symmetry problem is a foundational problem, then one must find a way to break the symmetry at the rheme-pragmatic level, i.e., by identifying a maxim that could serve as an additional, asymmetrical filter on symmetrical themes. To this end, many scholars have turned to something like the maxim of Manner-Conciseness. This general line of explanation has been quite popular for several decades, although it has also been criticized (e.g., Matsumoto 1995; Carston 2005). I will show that the role of conciseness in these approaches is quite different from its role in the previous section, and that it is ultimately unsatisfactory.

Consider the following, slightly different illustration of the symmetry problem:

(11) A: Are some of the students at the party, or all of them?
B: Some of them are there. *(implied: not all, according to B)*

The symmetry problem arises here if both "all" and "some-but-not-all" are assumed to be thematic (I will leave the restriction to students implicit for reasons of conciseness):

$$\mathcal{T}_0 = \{^\wedge\exists xPx, ^\wedge\forall xPx, ^\wedge(\exists xPx \wedge \neg\forall xPx), \ldots\} \qquad \text{(hypothetical)}$$

As in example (1), with which this chapter started, assuming that B's utterance complies with I-Quantity (with the informational intent $^\wedge\exists xPx$) lets us conclude that she was unable to assert anything stronger:

$$\neg\Box\forall xPx \qquad \neg\Box(\exists xPx \wedge \neg\forall xPx)$$

where the latter directly contradicts the exhaustivity implication we would wish to derive. (In Attentional Pragmatics B's attentional intent $\{^\wedge\exists xPx\}$ would again fail to comply with the maxims relative to the supposed theme, calling for the type of explanation given in the previous section.)

Approaches based on Manner-Conciseness attempt to solve the symmetry problem for cases like (11) by assuming that, although speaker B did not say or mention "some but not all" despite it being (supposedly) thematic and even true, this was not because of her lack of knowledge, but because "some but not all" is a considerably more complex thing to say. For "all" there is no corresponding excuse, because it is as simple as "some", hence the symmetry is broken. One way to formalize this would be to add a condition to the maxim of I-Quantity: a speaker should assert everything that she takes to be true, that is thematic, and that is *sufficiently easy to convey* (pseudo-formally):

$$\text{I-Quantity:} \quad (\text{relevant}(\varphi) \wedge \Box\varphi \wedge \text{easy-to-convey}(\varphi)) \rightarrow \text{assert}(\varphi)$$

For a recent proposal in this vein see Lassiter 2010.

Considerable research has been devoted to uncovering an appropriate notion of conciseness/complexity that can break the symmetry in all potentially problematic cases. For instance, expressions like "some but not all" would contain more syllables (McCawley, 1978), be less lexicalized (Atlas and Levinson, 1981), or be grammatically more complex (Katzir 2007, although this is not intended as part of a pragmatic explanation). The details of these various approaches will not concern us here, because the following criticism will be sufficiently general.

While a conciseness-based solution may seem to work for example (11), it does not apply straightforwardly to (2) above, repeated here:

(2) A: I need to know for all five people on this list (John, Mary, Bill, Sue, and Chris) whether they were present or absent.

B: John was present, and Bill was present.

A: Wow, only two, what a disappointment!

For conciseness to solve the symmetry problem in this case, it would have to provide B with a reason for omitting "and Mary was absent" (despite it being thematic and true), while providing her with no reason for omitting "and Mary was present" (such that the only available reason is that it is false) – yet the two additions have the same number of words. Moreover, a stipulated difference in degree of lexicalization, or a stipulated greater complexity for "absence" compared to "presence", would fail to account for the following example, the mirror image of (2):

(12) A: I need to know for all five people on this list (John, Mary, Bill, Sue, and Chris) whether they were present or absent.

B: John was absent, and Bill was absent.

A: Wow, only two, that's pretty good!

Here, for conciseness to solve the symmetry problem, it would have to provide B with a reason for omitting "and Mary was present", while providing her with no reason for omitting "and Mary was absent": the contrary of what was needed for example (2). Examples like (2) and (12) show that a conciseness-based solution to the symmetry problem that feeds only on intrinsic properties of lexical entries will be insufficient. Rather, there must be a contextual parameter of "mentionworthiness" that has nothing necessarily to do with conciseness or complexity as such.

Matsumoto (1995) criticizes conciseness-based accounts on similar grounds, by considering a number of utterances in which a simple expression and a more complex expression are used together, e.g.:

(13) It was warm today, and a little bit more than warm yesterday.

Matsumoto observes that the utterance implies that (according to the speaker) it was not a little bit more than warm today, despite this being expressible only by a more complex utterance. Lassiter (2010) defends the conciseness-based approach against this criticism by proposing that the use of the more complex utterance in (13) indicates that the context is one in which it would be worth mentioning. But this again shows that conciseness-based approaches must invoke a contextual parameter of "mentionworthiness" largely independent of considerations of conciseness or complexity. (Neither author considers examples like (2) and (12).)

Once the need for a contextual "mentionworthiness" parameter is acknowledged, let us just call this thing a "theme" and get rid of whatever symmetrical notion of relevance was used before (we can always obtain it by closing the notion of mentionworthiness or theme under negation, should we find a need for it). The resulting picture is essentially what Attentional Pragmatics offers, and in the previous section I have shown how it can solve the symmetry problem, in part based on considerations of conciseness. To clarify: the role of conciseness in my approach, based on the Thematic Organization Principle, is quite different from its purported role in conciseness-based approaches. There are two main differences.

First, the explanation I proposed, in terms of the Thematic Organization Principle, does not rely on the type of stipulated and potentially intricate notion of conciseness or complexity or lexicalization that is found in existing conciseness-based approaches. Rather, the Thematic Organization Principle relies on the obvious fact that, by means of an exhaustivity implication, one can communicate part of the answer implicitly. This is why the explanation offered applies analogously to (2) and (12), unlike existing conciseness-based approaches. By in a sense letting the symmetry problem solve itself, the current explanation generalizes better.

Second, according to the explanation offered by the Thematic Organization Principle, considerations of conciseness are not crucial for identifying the exhaustivity implication, from the perspective of an audience. Conciseness considerations may help explain *why* a speaker chose to address an asymmetrical theme, but *that* she did so will be evident regardless, as her utterance would not have complied with the maxims otherwise, and *which* asymmetrical theme she chose to address follows from considerations of clarity, and perhaps accent placement, rather than conciseness. In contrast, according to existing conciseness-based approaches, an audience cannot understand the utterance except by breaking the symmetry through considerations of conciseness. Carston (2005) criticizes the centrality of considerations of conciseness in these approaches, arguing that conciseness should be understood primarily as a means for achieving clarity, not as a goal in and of itself.

4.2 Approaches based on scales

Horn (1972) notes that words seem to be associated with inherently asymmetrical "scales" of expressions, e.g., "some" would be associated with the following scale:

⟨"all", "many", "some"⟩

These items form a scale, formally because they are completely ordered by strength (e.g., all members must be either downward entailing or upward entailing; Fauconnier 1975; Horn 2001; cf. Hirschberg 1985), and intuitively because they belong to the same "semantic field" (Levinson, 1983, he does not make the notion precise), and tend to be appropriate in the same range of utterances or contexts. For instance, in a context in which (14a) is uttered, we may guess, based on the above scale, that (14b) and (14c) could also have been uttered (by a hypothetical speaker with different beliefs):

(14) a. Some of the students are at the party.
b. All of the students are at the party.
c. Many of the students are at the party.

From (14a) we can obtain (14b) and (14c) by replacing the word "some" by items from the same scale. Let us call this the "substitution method" (following Geurts 2011) for obtaining a set of sentences from a sentence and a scale. We can take the

contents of those sentences, or the intents of corresponding utterances, in order to obtain a set of propositions that is similar to a theme in the current account.

Scales were invoked by Gazdar (1979) as a potential solution to the symmetry problem. The basic idea is to use the set of propositions obtained through the substitution method as a filter on a notion of relevance, where relevance itself is stipulated to be problematically symmetrical. The symmetry problem is then solved, superficially at least, because "some but not all" is not a member of the scale associated with "some" – because "some but not all" is neither weaker nor stronger than "all" – hence the resulting set of propositions, after filtering, will be asymmetrical. As Matsumoto (1995) and Russell (2006) point out, this is a non-solution unless it can be explained why the scale for "some" is the way it is, and why the set of propositions obtained by the substitution method should be appropriate to assume as a filter on a symmetrical notion of relevance. Gazdar himself makes no such attempt. To my awareness, the only explanation of why scales would be an appropriate filter on relevance is that of the conciseness-based approaches of McCawley (1978) and Atlas and Levinson (1981), mentioned above (these were in fact formulated in terms of scales). They propose constraints to the effect that all expressions on a scale must be equally brief, or equally lexicalized. I have already discussed why this type of approach is insufficient as a solution to the symmetry problem.

Despite this, Gazdar's approach has been widely adopted, lending exhaustivity its common name "scalar implicature". As Geurts (2011) notes, it's appeal seems to lie in its straightforward formalization, which bypasses the troubling notion of relevance altogether: exhaustivity can be derived purely syntactically, by blindly generating sentences via the substitution method, and putting a negation in front of sentences that are stronger than the one uttered. Geurts rightly criticizes this mechanistic approach to exhaustivity for being overly simplistic and even misleading, in the same spirit as my cautionary remarks with regard to the exhaustivity "operator" defined in chapter 3.

Although scales fall short as a solution to the symmetry problem, I will in the remainder of this section briefly explain where the notion of scale may fit in the current framework. As Geurts (2011) writes (p.52), the question of what scales are has received very little attention. There appear to be two views, or two kinds of scales:

(i) **Horn scale:** a representation of what is *typically* relevant (or, if one believes in the symmetry problem: relevant and concise enough) when a certain word is used;

(ii) **Hirschberg scale:** a representation of what is *actually* relevant (or: relevant and concise enough), at the time and place of a particular utterance in context;

Horn scales are also called "conventional" scales, and Hirschberg scales "contextual" or "ad hoc" scales (e.g., Hirschberg, 1985; Levinson, 1983; Huang, 2014).

According to Geurts (2011) and Lassiter (2010), the most common view on scales is what corresponds here to the Horn scale view, and it seems to me that it also underlies Horn's (1972) original proposal. According to this view, for instance, the scale for "some" would represent that, *typically*, when (14a) is uttered, (14b) and (14c) will also be worth uttering.

Clearly, a representation of what is *typically* relevant (or thematic), i.e., Horn's view on scales, will contribute to a theory of conversation, because it will help predict, for instance, what an audience may expect to be the theme for a given utterance, and explain how speakers rely on such expectations for achieving Compliance Transparency (chapter 4). Likewise, a representation of what is *actually* relevant, i.e., Hirschberg's view on scales, is of course helpful, if not crucial, like the notion of theme in the current account. But scales are arguably not the best means for representing these things (Geurts, 2011). For instance, not every set of propositions, a reasonably direct representation of a set of conversational goals, can be unambiguously represented by a sentence and a scale of words. To my awareness, this restrictiveness has not been motivated; indeed, it is mostly given up by Hirschberg (1985), who assumes that the members of a scale can be entire sentences, and that they need not be ordered by entailment – this of course lets us represent any set of propositions syntactically. But it is unclear why we should opt for a syntactic representation of relevance in the first place. Granted, for fully explicit, literal sentences, the substitution heuristic is a quick way for obtaining something like a theme. But what about impliciture and implicature? In order to represent the theme addressed by an indirect intent in terms of a scale, one would have to construct a set of sentences in the language at hand, one of whose semantic contents must correspond to what was implicated. In such cases scales are particularly inconvenient.

5 Conclusion

I have argued that there is no reason to believe that the symmetry problem would be a foundational problem: plausibly, our interests are often asymmetrical. Moreover, the symmetry problem as an empirical problem was shown to solve itself in Attentional Pragmatics, which predicts a thematic discontinuity precisely in the problematic cases. In such cases, I have argued, the Thematic Organization Principle enables speakers to address an asymmetrical theme despite symmetrical interests – a licit strategy in the sense of Roberts 2012 – so as to communicate part of the information by means of an exhaustivity implicature.

Once the relevant type of thematic reorganization is assumed, the proposed explanation works for any account of exhaustivity that runs into the symmetry problem, i.e., any account that predicts contradictory exhaustivity implications relative to a symmetrical theme. In contrast, existing proposals based on Conciseness and proposals based on scales were shown to be unsatisfactory.

Chapter 6

How to identify attentional intents

> Agents need not intend all the expected side-effects of their intentions.
>
> (Cohen and Levesque 1990, p.218, following Bratman 1987)

1 Introduction

I have not, thus far, motivated any of the attentional intents assumed for the relevant examples, for instance the examples in chapter 3 on exhaustivity. Although it seems to me that most of the assumed intents were quite intuitive, this is not sufficient justification – moreover, it may not be true for the following variant:

(1) A: Who is at the party?
B: John is there, and Mary is there.

$p_0 = {}^\wedge Pjm \qquad \mathcal{A}_0 = \{{}^\wedge Pjm\}$

I take it that B's utterance intuitively draws attention to John's presence (${}^\wedge Pj$) and to Mary's presence (${}^\wedge Pm$), and perhaps to their joint presence as well (${}^\wedge Pjm$) – but the assumed attentional intent ($\mathcal{A}_0$) contains only their joint presence. Indeed, different attentional intents would result in the wrong predictions, e.g., that the speaker thinks that they weren't both there, or that John's presence is possible independently of Mary's presence. Clearly, we must avoid these wrong predictions without the ad hoc assumption of a particular attentional intent. That is, we must explain on independent grounds why the attentional intent of (1) is exactly as assumed.

To that end, I will characterize the possible attentional intents of an utterance in terms of the sentence uttered. I will do so by assigning, in a systematic way, attentional *contents* to sentences. The relation between attentional content and (direct) attentional intent is then constrained primarily by the maxim of Content Efficacy (chapter 4), just as on the informational side: the first possible intent

that comes to mind, given some content of the utterance, must be an actual intent of the utterance. By considering which intents that come to mind are actually possible, I will derive a characterization of attentional intents in terms of the sentence uttered. Although partial, it will be sufficiently general and precise to justify the attentional intents assumed thus far, e.g., in chapter 3.

The notion of attentional content will not be a genuine enrichment of the semantic theory: in line with the heuristic of convention minimalism (chapter 2), it will be defined in such a way that we get it essentially for free, given the notion of informational content and a notion of syntactic constituent. The intended minimality of the notion does mean that a considerable part of the burden of deriving attentional intents from attentional contents will fall upon pragmatics, but this will have certain welcome consequences.

Outline Section 2 defines a minimal notion of attentional content. Section 3 employs the notion of attentional content to derive a characterization of attentional intents for a relevant range of assertions, as utterances of declarative sentences. Section 4 compares the resulting characterization of attentional intent to related notions in the literature, namely *attentive semantics* (Ciardelli, Groenendijk, and Roelofsen 2009; closely related to Hamblin semantics and Alternative Semantics (Kratzer and Shimoyama, 2002; Aloni, 2002; Alonso-Ovalle, 2006)), and *context-change potential* (e.g., Kamp 1981; Heim 1982; Groenendijk and Stokhof 1991, and much subsequent work). Section 5 more tentatively extends the general approach of section 3 to questions, as utterances of interrogative sentences. Section 6 concludes.

2 Attentional content

Intuitively, the attentional content of a sentence could be something like the set of things to which an utterance of the sentence would draw attention, as it were, by virtue of its literal meaning alone. As a technical notion, we can make this as intricate as we need, but in line with the heuristic of convention minimalism we should start minimal and see how far we get. To that end, I assume that the attentional content of a sentence is just the set of informational contents of its parts. I will briefly make this assumption a bit more explicit and precise.

I will refer to the syntactic structure α of a sentence, say, a tree, though without intending to commit to any particular theory of syntax. Let $\text{info}(\alpha)$ denote the informational content of α that an ordinary semantic theory could conceivably deliver, and let $\text{att}(\alpha)$ denote the attentional content of a sentence (with syntactic structure) α, defined as follows (not in Intensional Logic, but in the metalanguage):

6.1. Definition. **Attentional content**:
For any sentence with syntactic structure α to which the presupposed semantic theory assigns a single informational content, let its *attentional content* be the set of informational contents of its constituents, i.e.:

$$\text{att}(\alpha) = \{\text{info}(\beta) \mid \beta \text{ is a syntactic constituent of } \alpha\}$$

For instance, the attentional content of B's response in (1) above will include at least John, Mary, the property of being there, John's being there, Mary's being there, and John or Mary's being there. Definition 6.1 is minimal in the sense that it does not constitute a genuine enrichment of the semantic theory; it entails only that pragmatics has access to the (contents of) the constituents of a sentence. This is something which certain submaxims of Manner may need as well (cf. chapter 4), and it is quite innocent. In particular, as Simons (2011) notes, it does not commit us to a "localist" view on pragmatics according to which, roughly, constituents would be subject to the same rationality constraints as sentences.

The restriction of definition 6.1 to sentences that have only a single informational content is a simplification. Some authors assume multiple dimensions of informational content, e.g., conventional implicature (Grice 1989, ch.2; Potts 2005) or use-conditional content (Gutzmann, 2015), and I will assume something similar in part II for the channel of intonational meaning. One may in that case have multiple dimensions of attentional content as well, and generalize definition 6.1 accordingly. The formalization of rheme-pragmatics is already equipped for dealing with such a multi-dimensional semantic theory (e.g., $\mathbb{I}$ denotes a set of potentially multiple informational contents), but for present purposes it will not be necessary.

The relation between attentional content and intent is governed, as on the informational side, by the maxim of Content Efficacy (chapter 4): the first possible intents that come to mind, given a content, must be actual intents. I assume that the first candidate attentional intents that will come to mind will be subsets of the attentional content. This seems to me hard to avoid, but it is worth making explicit:

6.2. Assumption. The first candidate attentional intents that come to the mind of an audience, given an attentional content, are subsets of (or equal to) the attentional content.

After that, other states of affairs will come to mind through association according to patterns that have been described on the informational side in terms of completion, refinement, saturation, and so on (Bach, 1994; Recanati, 2004). If we ignore impliciture by considering only what are arguably literal utterances, the direct attentional intent will simply be a subset of the attentional content, and the question we face, as linguists or addressees, is which subset this is.

3 Identifying attentional intents

In this section I will explain how the notion of attentional content enables us to predict the attentional intents for a number of examples, working our way towards a more general characterization of attentional intent. As we will see, identifying the attentional intent of an uttered sentence may involve pragmatic considerations about, at least, the informational intent, the theme (and/or intonation), and Manner-Conciseness.

3.1 Atomic sentences, conjunction, negation

Consider a literal utterance of an atomic sentence, i.e., a sentence that does not contain any sentence as a proper constituent:

(2) B: John is at the party.

$p_0 = {\wedge}Pj \qquad \mathbb{A}_0 = \{{\wedge}Pj, {\wedge}P, {\wedge}j, \ldots\} \qquad \mathcal{A}_0 = \{{\wedge}Pj\}$

It does not really matter whether the attentional content ($\mathbb{A}_0$) contains the extensions or the intensions of the various sub-sentential constituents (e.g., j or ${\wedge}j$ for the name "John"). This is because, at least for utterances that are reasonably "literal", i.e., that do not rely on impliciture, only the states of affairs may end up in the attentional intent (this is a potentially simplifying assumption, see chapter 3, section 3.1). The first candidate attentional intent that will come to the mind of an audience, according to assumption 6.2, must be the one assigned to $\mathcal{A}_0$. It is also a possible intent, and even necessary, at least if the utterance is taken to comply with the maxims: by I-Quality speaker B must believe that John is at the party ($\Box Pj$) and by I-Relation that John's presence is thematic. The former implies also that she considers John's presence possible ($\Diamond Pj$), hence A-Quantity requires that she draws attention to it.

For a conjunctive utterance, consider again (1) from the start of this chapter, repeated here with a partial specification of the attentional content:

(1) B: John is there, and Mary is there.

$p_0 = {\wedge}Pjm \qquad \mathbb{A}_0 = \{{\wedge}Pj, {\wedge}Pm, {\wedge}Pjm, {\wedge}P, {\wedge}j, \ldots\} \qquad \mathcal{A}_0 = \{{\wedge}Pjm\}$

The attentional content ($\mathbb{A}_0$) contains three states of affairs: John's presence, Mary's presence, and their joint presence. To see why the attentional intent ($\mathcal{A}_0$) contains only the latter, let us assume again that B intended her utterance to comply with the maxims. From I-Quality and I-Relation applied to the informational intent (p_0) it follows that the speaker must believe that John and Mary are both at the party, and that this is thematic. This implies that the speaker considers John and Mary's joint presence possible and thematic, hence

she must draw attention to it. Moreover, it implies that she does not consider John's presence possible independently of Mary's and vice versa. Hence even if John's presence and Mary's presence are also thematic separately, which they may but need not be, A-Parsimony will prevent these from being included in the attentional intent. For this reason the attentional intent must be as assumed in (1): it is the only possible one that is a subset of the attentional content.

The following illustrates sentential negation:

(3) B: John isn't at the party.

$$p_0 = {}^\wedge\neg Pj \qquad \mathcal{A}\!\!\mathcal{A}_0 = \{{}^\wedge Pj, {}^\wedge\neg Pj, {}^\wedge P, {}^\wedge j, \ldots\} \qquad \mathcal{A}_0 = \{{}^\wedge\neg Pj\}$$

The utterance draws attention, by virtue of the contents of the sentence, to John's absence (${}^\wedge\neg Pj$) and John's presence (${}^\wedge Pj$). Supposing again that B takes her utterance to comply with the maxims, from I-Quality and I-Relation it follows that B must believe that John is absent and that this is thematic. It follows from A-Quantity that the attentional intent must contain John's absence. Moreover, Since B cannot at the same time consider his presence possible, by A-Quality it must not contain John's presence. This means that the attentional intent must be as assumed in (3).

In the foregoing examples we relied on the informational intent and its compliance with the maxims to identify the attentional intent. Indeed, the informational intent constrains the attentional intent more generally:

6.3. Fact. PROOF IN APPENDIX

For all normal pragmatic models $\mathbf{M}$ such that $\mathcal{T}_i$ denotes a theme that is closed under intersection:

$$\mathbf{M}, w_0 \models \forall p \forall \mathcal{A} \left(\left(\begin{array}{c} \text{I-MAXIMS}(p, \mathcal{T}_i) \wedge \\ \text{A-MAXIMS}(\mathcal{A}, \mathcal{T}_i) \end{array} \right) \rightarrow \left(p = \bigcup \mathcal{A} \right) \right)$$

This means that when addressing a theme that is closed under intersection, the attentional intent must be a *cover* of the informational intent, composed of thematic states of affairs. Moreover, given A-Parsimony, it must be a *strongest* cover, in the sense that it must not contain any state of affairs that can itself be covered by a set of more specific thematic states of affairs. It need not be a *minimal* cover, i.e., it may contain propositions that are not strictly necessary to cover the intent, as we saw in chapter 3, e.g., "John, or John and Mary". See also the proof of fact 6.3 in appendix B.

Fact 6.3 gives us a partial characterization of attentional intent. Although it relies on the assumption that the speaker takes her utterance to comply with the maxims, this characterization may hold more generally. As I suggested in

chapter 2, perhaps rational speakers who cannot comply with all the maxims will nevertheless prefer utterances that would have complied had their epistemic state been more informed. If so, then relative to such a hypothetical, more informed epistemic state fact 6.3 would apply as usual. For this reason the following may be defensible:

6.4. Assumption. (Tentative) Fact 6.3 generalizes to cases in which a speaker is unable to comply with the maxims with certainty.

But this will not be further motivated in this dissertation.

3.2 Disjunction

In the case of disjunctive utterances, multiple subsets of the attentional content may, as candidate intents, be compatible with fact 6.3. For instance:

(4) B: John is at the party or Mary is at the party.

$p_0 = {}^\wedge(Pj \vee Pm)$
$\mathcal{A}_0 = \{{}^\wedge Pj, {}^\wedge Pm, {}^\wedge(Pj \vee Pm), {}^\wedge P, {}^\wedge j, \ldots\}$

a. $\mathcal{A}_0 = \{{}^\wedge Pj, {}^\wedge Pm\}$; or
b. $\mathcal{A}_0 = \{{}^\wedge(Pj \vee Pm)\}$

Several subsets of the attentional content can cover the informational intent, which is what fact 6.3 requires of attentional intents: sets containing only the two disjuncts (option a. in (4)), just the disjunction as a whole (option b.), or combinations thereof (e.g., $\{{}^\wedge(Pj \vee Pm), {}^\wedge Pm\}$). I will ignore the latter, because such combinations violate A-Parsimony if we assume that, in a context in which (4) is uttered, John's presence is thematic if and only if Mary's presence is (i.e., neither is or both are).

The choice among options a. and b. is predicted to depend on the theme. If the individual disjuncts are not thematic, then option a. is ruled out by A-Relation; and if the individual disjuncts are thematic, then the speaker must not know either disjunct (I-Quantity), but she must know the disjunction as a whole (I-Quality), and hence consider each disjunct possible, hence the attentional intent would have to contain both (A-Quantity), i.e., option a. This predicted theme-dependence has an interesting consequence. As is well-known, something like the theme being addressed is often reflected by intonation, and in particular accent placement (e.g., Rooth 1992; Roberts 2012; Beaver and Clark 2009; for disjunctions in particular see Roelofsen and Van Gool 2010; cf. Han and Romero 2004a; Beck and Kim 2006; Biezma and Rawlins 2012). This means that intonation is predicted to potentially disambiguate the attentional intent of (4).

For the sake of concreteness, and ignoring many details, the following pattern of disambiguation could plausibly be predicted (where small caps means that the word receives a rising or falling accent, cf. part II on intonation):

(5) a. B: JOHN or MARY is there.

$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb, ^\wedge Ps\}^{\cap,\cup}$ $\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm\}$

b. B: John or MARY is there.

$\mathcal{T}_0 = \{^\wedge(Pj \vee Pm), ^\wedge Pb, ^\wedge Ps\}^{\cap,\cup}$ $\mathcal{A}_0 = \{^\wedge(Pj \vee Pm)\}$

However, this prediction is a conjecture – accent placement is a complex topic that is somewhat peripheral to the main point of this chapter, and also part II will not really be concerned with accent placement. Leaving the details for another occasion, the potentially predicted intonation-dependence of attentional intents, via pragmatics and something like a theme, would be what Beaver and Clark (2009) call a case of "quasi association with focus". It contrasts with the more semantic approach of Roelofsen and Van Gool 2010, in which something like attentional intents are stipulated to depend directly on intonation, by virtue of a compositional semantics. The two types of approaches will be compared in a bit more detail in section 4 below.

Knowledge about the theme or intonation does not always suffice for determining the attentional intent of a disjunction. Consider the following example (this is (2) from chapter 3):

(6) A: Who (of John, Mary and Bill) are at the party?
B: John is there, or both John and Mary.

$p_0 = {^\wedge Pj}$
$\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pjm, ^\wedge Pm, ^\wedge P, ^\wedge j, \ldots\}$ $\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pjm\}$

Fact 6.3 permits two attentional intents, namely the one given in (6), but also the singleton set containing only John's presence ($\{^\wedge Pj\}$), and both could in principle comply with the maxims relative to the same type of theme. In this case, the maxim of Manner-Conciseness comes to the rescue (chapter 4): every part of the utterance must contribute to the communication of some intent. Because the second disjunct in (6) is unnecessary for conveying the informational intent ($^\wedge Pj$), it must be necessary for conveying the attentional intent, which means that the attentional intent must contain John and Mary's joint presence ($^\wedge Pjm$), as assumed in (6).

The types of considerations that helped identify the attentional intents of the disjunctive utterances in (6B) and (4) apply more generally to sentences in *disjunctive normal form*. A sentence is in disjunctive normal form if it is a disjunction of conjunctions of simple sentences (atomic sentences and their negations). With regard to such sentences, the following holds:

6.5. PREDICTION. Any literal utterance (i.e., without impliciture, to keep things simple) of a sentence φ in disjunctive normal form will have as an attentional intent $\mathcal{A}_0$:

$$\mathcal{A}_0 = \{\text{info}(\psi) \mid \psi \text{ is a disjunct of } \varphi\}$$

provided (i) all (negations of) atomic sentences that occur in φ are thematic, (ii) the theme is closed under union and intersection, and (iii) the utterance complies with the maxims.

The prediction relies on fact 6.3 for the inclusion in $\mathcal{A}_0$ of the weakest disjuncts (like ^Pj in (6B)), which are necessary for the attentional intent to cover the informational intent, and on Manner-Conciseness for the inclusion in $\mathcal{A}_0$ of non-weakest disjuncts (like ^Pjm in (6B)), which would otherwise not serve a purpose.

3.3 Conjunction of disjunctions

The following utterance is not in disjunctive normal form, hence prediction 6.5 does not apply:

(7) A: Who (of John, Mary, Bill, Sue, ...) is at the party?
B: John or Mary is there, and Bill or Sue.

$$\mathbb{p}_0 = {}^\wedge((Pj \vee Pm) \wedge (Pb \vee Ps))$$
$$\mathbb{A}_0 = \{{}^\wedge Pj, {}^\wedge Pm, {}^\wedge(Pj \vee Pm), {}^\wedge Pb, {}^\wedge Ps, \ldots, {}^\wedge P, {}^\wedge j, {}^\wedge m, \ldots\}$$

The example includes a specification only of the informational and attentional content. With regard to the intents, I will explore two options. The first option consists in assigning to (7) a single informational intent and a single attentional intent:

a. $p_0 = {}^\wedge((Pj \vee Pm) \wedge (Pb \vee Ps))$
$\mathcal{A}_0 = \{{}^\wedge Pjb, {}^\wedge Pjs, {}^\wedge Pmb, {}^\wedge Pms\}$

As I will show, this possible analysis faces some problems. The second option consists in assigning to (7) *two* intents of each type, namely the following:

b. $p_0 = {}^\wedge(Pj \vee Pm)$ $\quad$ $p_1 = {}^\wedge(Pb \vee Ps)$
$\mathcal{A}_0 = \{{}^\wedge Pj, {}^\wedge Pm\}$ $\quad$ $\mathcal{A}_1 = \{{}^\wedge Pb, {}^\wedge Ps\}$

I will briefly compare the two options, and tentatively conclude in favor of option b.

If we assume the standard type of theme for A's question, and thematic continuity, then fact 6.3 commits us to an attentional intent like option a. (though possibly including also more specific states of affairs, like $^{\wedge}Pjbm$). However, note that none of its states of affairs is an element of the attentional content of (7B). What B should have uttered for intent a. to have been a subset of the attentional content is the following:

(8) John and Bill were there, or John and Sue,
or Mary and Bill, or Mary and Sue.

Hence, if the assumed attentional intent of option a. is on the right track, its communication must involve an attentional form of impliciture. Perhaps one could argue that attention drawn to two states of affairs could spread to their intersection, and that some pragmatic constraints would then cast aside all states of affairs except those in the purported intent of option a. Developing this type of account in detail seems to me potentially challenging. Moreover, it would arguably leave unexplained why B uttered (7B) rather than (8), which, although it is awfully long, does express the purported intent more directly. It seems to me that (8) is dispreferred not just because it is long, but because the attentional intent itself is particularly complex, involving four combinations of four individuals. If option a. is correct, and B in (7) is indeed drawing attention to those four combinations via impliciture, rather than opting for the literal utterance (8), B is arguably making the task for an audience harder rather than easier.

Option b. is more satisfying in this regard, and it becomes available once we drop the assumption of thematic continuity. Suppose that the Thematic Organization Principle allows B to split up the theme of (7A) into two parts, one about John and Mary (potentially along with some others), and another about Bill and Sue (potentially along with some others). Ignoring the other individuals for simplicity, the reorganized themes addressed by (7B) would be the following:

$\mathcal{T}_0 = \{^{\wedge}Pj, ^{\wedge}Pm\}^{\cap,\cup}$ $\mathcal{T}_1 = \{^{\wedge}Pb, ^{\wedge}Ps\}^{\cap,\cup}$

Just like the thematic reorganization assumed in chapter 5, which consisted in splitting a theme into a negative and a positive part, the type of reorganization invoked here constitutes an ordinary *strategy* in the sense of Roberts 2012 (though not in the sense of the current Strategy Principle). It is easy to see that the assumed intents of option b. can comply with the maxims (and with fact 6.3) relative to their corresponding themes. Moreover, the attentional intents are subsets of the attentional content, which explains how they can be clearly communicated. The informational intents may be clearly communicated in part by virtue of fact 6.3, which implies that they must be the unions of their attentional counterparts, but they also relate to the informational content in a way that is arguably a safe type of impliciture, i.e., from a conjunction to its conjuncts. A similar relation

between a single informational content and multiple informational intents may obtain in the case of (conjunctive) interjections, and perhaps also in the case of non-restrictive relative clauses.

Option b. does not rely as heavily as option a. on the imprecise notion of impliciture, but rather on a theme-pragmatic maneuver of the sort found in the literature. Moreover, option b. offers a more satisfying explanation for why B uttered (7B) rather than (8): it addresses simpler themes by means of simpler attentional intents. Note that, if option a. is not really an option, it will be clear to an addressee that (7) must involve a thematic discontinuity. Conversely, even the mere possibility of option b. may threaten the purported impliciture on which option a. would supposedly rely, because option b. could come to the mind of an audience first. In sum, option b. seems to me superior: conjunctions of disjunctions like (7) most likely involve a thematic reorganization, such that each conjunct addresses a separate theme.

4 Comparison to existing work

I will compare the current approach to two related strands in the literature: in some detail to *attentive semantics*, which is similar or equivalent to certain uses of Alternative Semantics or Hamblin semantics in the literature, and more briefly to work on discourse referents and anaphoric reference.

4.1 "Attentive content"

The notion of attentional *intent* in the present work was inspired by the notion of *attentive content* in Ciardelli, Groenendijk, and Roelofsen 2009 (cf. Ciardelli 2009; a variant is defined in Roelofsen 2013a). I will highlight a number of important differences and correspondences. To avoid confusion I will write "attentive*" for their notion, and keep writing "attentional" for mine (I chose "attentional" rather than "attentive" because one can intend to draw attention to things without thereby being attentive, i.e., careful or forthcoming). Ciardelli et al. use attentive* content in their proposal that sentences containing the epistemic modal "might" would serve primarily to draw attention to things. Since modality is a large topic in its own right, I will not discuss this side of their proposal here, but only the notion of attentive* content itself. (A similar attentional take on "might" is independently pursued by Brumwell (2009); see Bledin and Rawlins 2016 for a more recent and more sophisticated attention-based account of "might"-utterances.)

Attentive* content is, at a purely technical level, equivalent to more common occurrences of proposition sets in semantics, namely those of *Alternative Semantics* or *Hamblin semantics* as applied to indefinites and disjunctions (e.g., Kratzer and Shimoyama 2002; Aloni 2002; Alonso-Ovalle 2006). I will concentrate on Ciardelli et al.'s notion because of its explicit motivation in terms of attention, which

these other accounts lack. Alternative Semantics was originally motivated rather as a semantic representation of something like the communicative importance of a constituent (*focus*; Rooth 1985), and Hamblin semantics was motivated as a representation of the semantic contents of interrogative sentences (Hamblin, 1973). Although nowadays these notions are often employed in a way that superficially lends itself to an attentional interpretation, this can only be assessed one phenomenon at a time, which I will leave for another occasion. (As far as the phenomenon of exhaustivity goes: in chapter 3 I already pointed out a close correspondence between the exhaustivity operator in Alonso-Ovalle 2008, based on Alternative Semantics, and mine.)

Ciardelli et al. do not explicitly distinguish contents from intents. On the one hand they assign attentive* contents to sentences by a compositional semantics, but on the other hand they motivate the precise definition of the semantics in terms of the *proposal* that a sentence expresses, and, more explicitly in Roelofsen 2013a (p.194), the things to which a *speaker* would intuitively be drawing attention when uttering the sentence. Moreover, pragmatic constraints like A-Quality (Roelofsen's "attentive sincerity") are applied to attentive* contents as if they were intents. In what follows I will mostly conceive of attentive* content as a "semanticized" version of attentional intent.

The relevant part of Ciardelli et al.'s semantic definition of attentive* content is as follows (Roelofsen (2013a) defines attentive* content slightly differently, see further below):

6.6. Definition. **Attentive* content** (Ciardelli, Groenendijk, and Roelofsen 2009):
Let $\text{att}^*(\varphi)$ denote the *attentive* content* of a sentence φ, defined recursively as follows, for φ and ψ arbitrary sentences, and p an arbitrary atomic sentence, in a propositional language:

$$\begin{array}{lcl} \text{att}^*(p) & = & \{\underline{\text{info}}(p)\} \\ \text{att}^*(\neg\varphi) & = & \{\overline{\bigcup\varphi}\} \\ \text{att}^*(\varphi \wedge \psi) & = & \text{att}^*(\varphi) \sqcap \text{att}^*(\psi) \quad (= \{a \cap b \mid a \in \text{att}^*(\varphi), b \in \text{att}^*(\psi)\}) \\ \text{att}^*(\varphi \vee \psi) & = & \text{att}(\varphi) \cup \text{att}(\psi) \end{array}$$

The notion of attentive* content is defined for a propositional logic, though with a straightforward correspondence between the logical connectives and their natural language counterparts in mind.

There is a close correspondence between attentive* content, defined thus, and the current notion of attentional intent. For instance, it follows from Ciardelli et al.'s definition that the (classical) informational content of any sentence is equivalent to the union of the attentive* content, which is precisely what fact 6.3 states about informational and attentional *intents* relative to certain types of

themes. Moreover, the attentive* content of any sentence in disjunctive normal form (a disjunction of conjunctions of simple sentences) is, according to their definition, equivalent to the set of informational contents of the disjuncts. This is what prediction 6.5 states about attentional intents, though again only relative to certain types of themes. Perhaps Ciardelli et al.'s motivating intuitions about attention were sensitive to something like the A-maxims.

Ciardelli (2009) notes that the attentive* content of any sentence is equivalent to the attentive* content of a certain disjunctive normal form, that can be obtained from the sentence by distributing conjunctions over disjunctions. This is considerably more general than prediction 6.5, which applies only to sentences that are themselves in disjunctive normal form. As a consequence, examples (7B) and (8) above, repeated here as (9a,b), get the same attentive* content:

(9) a. B: John or Mary is there, and Bill or Sue.
b. B: John and Bill were there, or John and Sue,
or Mary and Bill, or Mary and Sue.

The attentive* content of both sentences alike is:

$$\{^\wedge Pjb, ^\wedge Pjs, ^\wedge Pmb, ^\wedge Pms\}$$

This corresponds to the attentional intent that prediction 6.5 would assign to (9b), i.e., (8) above. This is the attentional intent, recall, of the "option a." analysis of (9a), i.e., (7B) above, which faced some problems on the current account.

Because Ciardelli et al. semanticize what may be pragmatic, their approach may be more costly than necessary, and less explanatory than possible. For instance, their definition of attentive* content treats conjunction and disjunction differently in a way that, as I have shown, can be explained pragmatically and need not be assumed – my definition 6.1 of attentional content applies indiscriminately to any type of sentence. Similarly, while we get the apparent theme-dependence and potential intonation-dependence of attentional intents for free, Ciardelli et al.'s definition for conjunction and disjunction would have to be amended for the same empirical coverage (e.g., (5), and also the "option b." analysis of (9b), i.e., (7)). Indeed, Roelofsen and Van Gool (2010) define their closely related notion of *highlighting* in such a way: a disjunction with accents on the disjuncts would highlight each individual disjunct, while a disjunction with a single accent would highlight only the disjunction as a whole.

For concreteness, here is a possible way to refine Ciardelli et al.'s definition for disjunction in a way that takes the theme into account (where $A \sqcup B$ is pointwise union: $\{a \cup b \mid a \in A, b \in B\}$):

$$\text{att*}(\varphi \vee \psi) = \begin{cases} \text{att*}(\varphi) \cup \text{att*}(\psi) & \text{if the states of affairs therein are thematic;} \\ \text{att*}(\varphi) \sqcup \text{att*}(\psi) & \text{otherwise.} \end{cases}$$

(When the second case obtains, att*(φ) and att*(ψ) will normally contain only a single, athematic state of affairs each.) And here is a way to refine the definition for conjunction to deal with utterances like (9a) (i.e., (7)) that, if the theme-pragmatic explanation is correct, address a different theme with each conjunct:

$$\text{att*}(\varphi \wedge \psi) = \begin{cases} \text{att*}(\varphi) \sqcap \text{att*}(\psi) & \text{if } \varphi \wedge \psi \text{ addresses a single theme;} \\ \text{att*}(\varphi) \cup \text{att*}(\psi) & \text{if } \varphi \text{ and } \psi \text{ address different themes.} \end{cases}$$

(Depending on the details of impliciture, it may be reasonable to assume that the second option may occur only with top-level conjunctions.) Perhaps coincidentally, this second option corresponds somewhat to an alternative definition of attentive* content for conjunction in Roelofsen 2013a, the essence of which is also union.

I have not shown, of course, that the current, minimal notion of attentional content of definition 6.1 will in general suffice to predict the right attentional intents. But if it does, then the definition of attentive* content, appropriately refined, can be regarded as a mere abbreviation of the attentional intents that the pragmatic theory predicts anyway, at least relative to certain types of themes (though for an abbreviation it is not particularly brief). A similar abbreviation was presented in chapter 3, the "exhaustivity operator", and the same cautionary remarks apply here: as a shortcut, it may not generalize as well, and its application is only explanatory in the circumstances in which it can be derived from the pragmatic account.

This chapter, and the above comparison, has been limited to a propositional (fragment of a) language. Ciardelli (2009) defines attentive* content also for a first-order logical language, treating universal and existential quantification as generalized conjunction and disjunction, i.e., generalized pointwise intersection and union. Since quantification does not play a central role in this dissertation, I will only briefly and tentatively suggest that the partial correspondence between our approaches extends to the first-order case. Let us assume that the logical quantifiers correspond to their natural language counterparts, i.e.:

(10) a. Everyone is at the party.
b. Someone is at the party.

The attentive* contents for these sentences would be (leaving a domain restriction implicit):

$$\begin{aligned} \text{att*(10a)} &= \{{}^\wedge\forall x P x\} \\ \text{att*(10b)} &= \{{}^\wedge P j, {}^\wedge P m, {}^\wedge P j m, \ldots\} \end{aligned}$$

When conceived of as attentional intents, these objects would comply with the A-maxims relative to the theme of who was at the party, and align with fact 6.3. Moreover, for (10a) the attentive* content is a subset of its attentional content

according to definition 6.1, so as an intent it could comply also with Content Efficacy.

The latter does not hold for the existential quantifier: the attentive* content of (10b) is not a subset of its attentional content, the only state of affairs in which will be that someone is at the party ($^\exists xPx$). Hence, for the attentive* content of (10b) to comply (as an intent) with Content Efficacy, we must assume that attention drawn to *someone* being present may spread to the presences of particular (groups of) individuals. This would be a form of impliciture, and it would rely, for its clear communication, on the fact that merely drawing attention to someone being at the party ($^\exists xPx$) would have violated A-Quantity. The purported form of impliciture seems to me particularly plausible for a more explicit version:

(11) Someone of John, Mary and Bill is at the party.

It seems to me plausible that this would indirectly draw attention to the presence of each individual separately, and hence that it could communicate an attentional intent equivalent to the attentive* content. Since the only difference between (11) and (10) is a quantifier domain restriction, the addition of which is arguably a common form of impliciture (Bach, 1994), (10) can potentially communicate the same intent as (11). If so, then the partial correspondence between Ciardelli's attentive* content and the current notion of attentional intent extends to the quantifiers.

4.2 Discourse referents and anaphora

The things to which an utterance draws attention have long been noted to be relevant for an account of anaphoric reference. To illustrate:

(12) A: John was dancing all night.
B: I guess so. He never grows tired of it.

Speaker B uses the anaphor "so" to refer to the proposition that John was dancing all night, "he" to refer to John, and "it" to refer to the activity of dancing. Such anaphoric reference is possible because A's prior utterance made each of these things salient, i.e., drew attention to them. The things made salient are often called "discourse referents", and within the formal semantics literature the set of discourse referents introduced by an utterance is typically described in terms of the notion of *context-change potential*, a type of semantic content that is assumed on top of the classical, informational content (see Kamp 1981; Heim 1982; Groenendijk and Stokhof 1991 and much subsequent work, for a recent overview and implementation see Dekker 2012; for a less semantics-oriented approach to anaphora see Brennan, Friedman, and Pollard 1987; Grosz, Weinstein, and Joshi 1995).

Ideally, the current notion of attentional content would be a sufficient semantic basis both for an account of attentional intents and for a theory of anaphoric reference. Indeed, there are some close correspondences. For instance, Aloni (2002) derives something like the aforementioned Hamblin/Alternative Semantics treatment of disjunctions from the purported context-change potential of existential sentences, by analyzing a disjunction like "John is there, or Mary" in terms of an existential quantifier:

$$\exists p(^{\vee}p \wedge (^{\vee}p = Pj \vee {}^{\vee}p = Pm))$$

And Schulz and Van Rooij (2006) rely on this analysis for distinguishing "John is there" from "John, or John and Mary", i.e., the core contrast in chapter 3. To give another example, Krifka (2013) argues that negative sentences draw attention both to the negative proposition expressed by the matrix sentence and to the positive proposition expressed by the embedded sentence, which is what I assumed earlier with regard to example (3), in line with definition 6.1 of attentional content.

These correspondences between attentional content and anaphoric potential notwithstanding, definitions of the latter are typically more complex than my definition of the former: the notion of context-change potential is typically defined, unlike definition 6.1 but like the notion of attentive* content discussed above, in a way that discriminates between different types of sentences. (In this regard Aloni's and Krifka's proposals are non-trivial.) As I did for the notion of attentive* content above, one could try to explain and avoid the complexity of current definitions of context-change potential by moving part of the burden to pragmatics. I will not pursue this at present, but I will briefly point out two ways in which this could be (and to some extent has been) attempted.

The first is that, as is well-known, what matters for anaphoric reference is not just the attentional content, but what we may call the "attentional potential", i.e., the set of everything to which an utterance draws attention, whether in virtue of the semantic content or more indirectly (cf. "informational potential" in chapter 2). For instance, Kamp and Reyle (1993) propose that the referent of the plural anaphor "they" in examples like (13a) is constructed via a *summation* inference rule, making the group of John and Mary available for anaphoric reference despite the utterance mentioning only each individual separately; Nouwen (2003) argues that anaphoric reference to a quantifier's *complement set* as in (13b) is likewise indirect:

(13) a. John met Mary. They talked for hours.
b. Few students came to the party. They were studying for an exam.

A more general inference rule is proposed by Schwarzschild (1999), though to my awareness not with anaphora in mind: something is salient (or "given") if its existence is contextually entailed by a preceding utterance. The explanatory potential of this rule for an account of anaphora has not, to my awareness, been investigated.

The second way in which part of the burden of accounting for anaphoric reference may be moved to pragmatics is by acknowledging that not everything that is made salient is necessarily available for anaphoric reference. For one, certain things may become more salient than others, and hence come to mind more quickly as a suitable referent (e.g., Brennan, Friedman, and Pollard, 1987; Grosz, Weinstein, and Joshi, 1995). Moreover, the interpretation of anaphora is constrained by the fact that utterances containing them must themselves make a relevant and clear contribution to the conversation (e.g., Spenader, Smits, and Hendriks, 2009; Roberts, 2011). Such pragmatic constraints are well-known, but I am unaware of a systematic investigation into the degree to which pragmatic constraints may render redundant certain features of the notion of context-change potential.

Given the shared role of attention in accounts of anaphoric reference and in the communication of attentional intents, the notion of attentional content would ideally serve as a unified semantic basis for both. Although the current notion of attentional content is rather simplistic compared to the notion of context-change potential in the literature, it seems to me too early to decide whether it could nevertheless be sufficient. Moreover, I have not conclusively proven its sufficiency for the communication of attentional intents either, although in that respect it seems to get us quite far. Perhaps the notion of attentional content will ultimately have to be refined, and be understood as a genuinely different dimension of meaning, governed by a set of linguistic conventions separate from those underlying informational content. This would be discouraged by convention minimalism, but not forbidden if necessary. I have merely outlined a parsimonious starting point.

5 Questions (tentative)

I will tentatively extend the foregoing approach to *questions*, in the technical sense of utterances of sentences in syntactic interrogative mood. In this section I will first justify why this can be left tentative given the aims of this dissertation, then explicate some assumptions about the contents and intents of questions, and then present three illustrations of how the attentional intents of questions may be identified: a disjunctive question, a conjunctive question, and a constituent question (or "wh"-question).

5.1 The role of questions in this dissertation

My account of the attentional intents of questions will be left tentative because:

(i) a more comprehensive account of the attentional intents of questions is not strictly necessary for the main aims of this dissertation; and

(ii) such an account would require a theory of the semantic contents of interrogatives, but existing formal accounts are not entirely satisfactory, and developing and defending an alternative in any sort of detail falls outside the intended scope of this dissertation.

I will clarify both reasons.

Regarding reason (i), although preceding chapters have occasionally relied on the purported attentional intents of questions, and the same will hold for most of the chapters in part II, this reliance could have been avoided. Questions were used only for setting up a particular context with (supposedly) a certain theme, in which a subsequent assertion could then be evaluated. But note that we could have used assertions to that end just as well. For instance, instead of a constituent question like (14a), with the assumed intent, we could have used a suitably explicit assertion like (14b), for which prediction 6.5 given earlier delivers the desired intent:

(14) a. Who (of John, Mary and Bill) are at the party?

$\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb\}^\cap$

b. John is there, or Mary, or Bill, or John and Mary, or John and Bill, or Mary and Bill, or all three of them.

Through A-Relation and the Continuity Principle, the assertion in (14b) sets up a theme for a subsequent response just like the question in (14a) supposedly would. (A slightly more natural, less explicit variant of (14b) would presumably achieve the same, e.g., "...or some combination of these three.") Hence, although for reasons of naturalness I have relied on questions for setting up a particular context, and although I have generally omitted explicit justifications for their purported attentional intents, this does not compromise the falsifiability of the theory's predictions with regard to the main phenomena.

As for reason (ii), existing formal accounts of the contents of interrogatives are somewhat unsatisfactory because, like attentive* semantics discussed above, they arguably semanticize aspects of questions that would ideally, in the current framework, be accounted for pragmatically, on the basis of a simpler semantics. Just to give an impression, without wishing to argue for these particular interpretations: *proposition-set* accounts seem to semanticize something like the notion of theme (Hamblin, 1973) or attentional intent (Biezma and Rawlins 2012; also "highlighting" in Roelofsen and Van Gool 2010); *partition semantics* (Groenendijk and Stokhof, 1984) seems to model something like the complete resolutions (positive or negative) of the underlying theme; and *inquisitive semantics* (Ciardelli, Groenendijk, and Roelofsen, 2013) models only the least informative propositions of the attentional intent. Of course these are all interesting aspects of questions, but in the current framework they would ideally be derived pragmatically from

the notions of attentional intent and attentional content, where the latter would be derived from a simpler semantics through something like definition 6.1.

Relation to the semantics of "wh"-complements

The aim to derive the aforementioned aspects of questions pragmatically from a simpler semantics does not exclude the possibility that such aspects can nevertheless be referenced linguistically, say, by means of words like "question", phrases like "complete answer", and constructions like "wh"-complements (as in "I know *who John loves*"), and potentially be part of the semantics of these expressions. The ordinary language concept of question may be very rich. However, it is frequently assumed that the semantic contents of "wh"-complements correspond exactly to the semantic contents of superficially similar matrix interrogative sentences. This is the "equivalence thesis" (Belnap 1982), which I *won't* adopt:

- **Equivalence thesis (not assumed)**: interrogative sentences are semantically equivalent to superficially corresponding "wh"-complements.

This thesis lies at the heart of several influential semantic accounts of interrogatives (e.g., Groenendijk and Stokhof, 1984), but it is not universally assumed (e.g., Roberts 2012, Biezma and Rawlins 2012).

I will not argue that the equivalence thesis is false, but only list the main reasons why I think it may not be correct or useful and why I do not assume it. First, matrix interrogatives and "wh"-complements in English appear not to be syntactically identical. Second, the two constructions serve very different purposes, namely asking a question versus talking about a question (compare building a house to talking about a house, where only the latter requires a linguistic expression that denotes a house). Third, even if the two constructions had been syntactically identical, they could still have differed semantically: it is unproblematic to assume polysemy as long as one can explain how the multiple senses came to be (say, by deriving one from the other diachronically) and how they can be reliably acquired and communicated – and the latter may be quite straightforward, because the two senses would serve different purposes and consistently occur in very different syntactic contexts (namely: embedded vs. unembedded). Fourth, even without assuming the equivalence thesis, a theory about actual questions, i.e., the use of matrix interrogatives, may of course inform a theory about the ordinary language concept of question, i.e., the meanings/uses of expressions like "wh"-complements and the word "question". (Analogously, a better understanding of actual houses and how people use them may facilitate an understanding of how people use the word "house".) But to assume equivalence from the start seems to me a remnant of ordinary language philosophy (cf. chapter 1).

I will not develop these summary points into proper arguments, because the remainder of this section will be of some value even if one subscribes to the equivalence thesis. First, my minimal assumptions about the contents of matrix

interrogatives may invite one to explore a similarly minimalist approach for "wh"-complements. Second – in case such an approach fails – one could assume that what I aim to derive pragmatically from a very minimal semantic content has in fact conventionalized, i.e., that certain aspects of questions that were once pragmatic are now part of the semantics of interrogative sentences and "wh"-complements alike, governed by linguistic conventions that cannot be further reduced to rationality. As I explained in chapter 1, a more diachronic (re)interpretation does not necessarily rid rationality considerations of their explanatory potential.

5.2 Contents and intents of questions

In chapter 3 I already suggested that questions may be treated as purely attentional contributions. I will now make this more explicit:

6.7. Assumption. **Intents of questions:**
Questions (as utterances of interrogative sentences) address their main theme only with an attentional intent; they lack a main informational intent.

Within the current theory, this assumption seems to me a parsimonious starting point. And it may well be sufficient to explain what questions are for: by drawing attention to propositions of the main theme while not confirming any, the main effect of a question would be to set goals for the next speaker (via the Continuity Principle). From this effect, certain other aspects of questions could perhaps be derived, such as the minimal or exhaustive resolutions of the underlying theme that some of the aforementioned semantic theories seem to model. Although I will not in this dissertation try to prove that assumption 6.7 suffices for a fully general account of questions, I will show in chapter 12 that it enables a satisfying account, at least, of question intonation.

What matters for the purposes of this section is that, if indeed questions lack a main informational intent, then fact 6.3 and prediction 6.5 are useless for identifying the attentional intents of questions: they constrain attentional intents only *given* an informational intent, which questions are assumed to lack. But we do get a new constraint in return: if questions lack an informational intent, Manner-Conciseness entails that basically all the uttered material must somehow contribute to conveying the attentional intent (similarly, in the case of assertions discussed earlier, Manner-Conciseness came into play when material was uttered that did not contribute to conveying the informational intent, e.g., non-weakest disjuncts such as "or both"). Below I will illustrate how this constraint may assist in identifying the attentional intents of questions.

Once the assumption is granted that questions lack a main informational intent (assumption 6.7), which seems uncontroversial, we have yet to explain how an addressee might figure this out, i.e., how an addressee might come to

understand, on the basis of the uttered interrogative, that the utterance has no main informational intent. The following assumption about the contents of interrogatives achieves this in a very direct way – but it is only tentative, and it is included here mainly for the sake of concreteness (subsequent chapters, e.g., chapter 12 on question intonation, will not rely on it):

6.8. Assumption. **Contents of interrogatives (tentative):**
Interrogative mood does not affect the main informational content of a sentence. Rather, it contributes an additional, separate informational content, that serves to convey, as a less prominent informational intent, the proposition *that the utterance lacks a main informational intent* (and, moreover, that the I-maxims do not apply; see chapter 12).

Interrogative mood, according to this assumption, serves as a meta-pragmatic marker, without changing the main contents. This type of approach was proposed already by Frege (1918, p.62): in his (translated) terms, interrogative mood would serve only to indicate the *force* of the utterance, without changing its *content*.

To my awareness, nothing like assumption 6.8 has been seriously pursued in the recent formal semantics literature on questions. (It does resemble recent formal accounts of intonation and discourse particles (e.g., Gutzmann 2015), two linguistic features with which interrogative mood seems to have some affinity cross-linguistically.) One reason for this is that the Fregean approach to questions has been criticized for failing to account for the semantics of "wh"-complements (e.g, Groenendijk and Stokhof, 1997) – but such criticism, which relies on the equivalence thesis, may not be relevant in the current framework. Another reason is that, as Frege himself noted, informational content alone seems to be insufficient for distinguishing, e.g., "was John there or not?" from "was Mary there or not?", both of which would express a tautology. But the latter problem dissolves once we take the informational contents of all constituents into account, i.e., the attentional content according to definition 6.1. For this reason I think that the "neo-Fregean" approach embodied by assumption 6.8 deserves a closer look – though I will leave such a closer look for another occasion.

A somewhat Fregean approach to questions has been pursued in the "speech act" literature, e.g., Searle 1969, Vanderveken 1990, and Krifka 2001b, but formalizations in that strand do not quite align with assumption 6.8: Krifka, for instance, treats interrogative mood not as leaving the main contents untouched and contributing a separate informational content, but as turning the main informational content into a different semantic object altogether, namely a "speech act", understood as an update function on discourse contexts. In contrast, assumption 6.8 will account for the different "update effects" of questions and assertions more indirectly, via the level of intents and the maxims.

Assumption 6.8 embodies a very direct (though still only partial) solution to a problem that is often overlooked, namely, that semantic objects underdetermine

the kinds of speaker intentions with which they may be used (Lauer 2013, pp.39-41). In particular, at least some of the existing accounts of the semantic contents of interrogative sentences fail to explain how interrogative mood manages to convey that the utterance lacks a direct informational intent, i.e., how interrogatives can be successfully used to ask questions rather than make assertions (this is not to say that questions cannot be assertion-like – see chapter 12 for an account of a certain type of rhetorical question). For instance, accounts according to which interrogatives would simply denote *incomplete* propositions (e.g., (Hausser, 1980), see further below) fall short of preventing the unintended communication of a direct informational intent, because completing an incomplete proposition is a prime example of impliciture (chapter 4). And the various accounts according to which an interrogative would denote a set of propositions may or may not face a similar challenge, depending on the details of Content Efficacy. Assumption 6.8 is only tentative, but at least it avoids these difficulties.

5.3 Identifying the attentional intents of questions

In the foregoing I assumed that questions lack a main informational intent, and that the main contents of interrogative sentences are like those of their declarative counterparts. In what follows I will show how this may enable us (as linguists, or as addressees) to identify the attentional intents. I will discuss a disjunctive question, a conjunctive question, and a constituent question ("wh"-question).

Disjunctive question According to assumption 6.8 and definition 6.1, the disjunctive interrogative in (15) has the same attentional content as the corresponding declarative in (4) discussed earlier:

(15) B: Is John at the party, or is Mary there?

$\mathcal{A}_0 = \{^Pj, ^Pm, ^(Pj \vee Pm), ^P, ^j, \ldots\}$ a. $\mathcal{A}_0 = \{^Pj, ^Pm\}$; or
b. $\mathcal{A}_0 = \{^(Pj \vee Pm)\}$

The possible attentional intents, too, are identical to those of the corresponding assertion in (4), but not for the same reason. Take, for instance, the singleton set $\{^Pj\}$. In (4) this was not a valid attentional intent because of fact 6.3: the informational intent must be the union of the attentional intent. In (15), in contrast, where there is no informational intent, the singleton set is instead ruled out by Manner-Conciseness: if $\{^Pj\}$ had been the attentional intent of (15), then the second disjunct of the question would have served no purpose. In this way, Manner-Conciseness may, in the case of questions, take over at least part of the role that fact 6.3 plays in the case of assertions.

The predicted attentional ambiguity of (15) may be resolved, just as in (4), with the help of accent placement:

(16) a. B: Was JOHN or MARY there?

$\mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb, ^\wedge Ps\}^{\cap,\cup}$ $\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm\}$

b. B: Was John or MARY there?

$\mathcal{T}_0 = \{^\wedge(Pj \vee Pm), ^\wedge Pb, ^\wedge Ps\}^{\cap,\cup}$ $\mathcal{A}_0 = \{^\wedge(Pj \vee Pm)\}$

This expected pattern aligns with the definition of attentive* content of Roelofsen and Van Gool 2010, showing again (though of course in certain respects only tentatively) how we may indirectly, pragmatically derive what other accounts semanticize.

Conjunctive question Manner-Conciseness is less restrictive than fact 6.3. For instance, whereas the attentional intent of a conjunctive assertion can only contain the conjunction as a whole – or else the informational intent would not be its union – the attentional intent of a conjunctive question may in principle, as far as Manner-Conciseness is concerned, contain both conjuncts separately instead. Hence, conjunctive questions are predicted to be potentially attentionally ambiguous in a way that conjunctive assertions are not:

(17) B: Is John at the party, and is Mary there?

$\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge(Pj \wedge Pm), ^\wedge P, ^\wedge j, \ldots\}$ a. $\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm\}$; or b. $\mathcal{A}_0 = \{^\wedge Pjm\}$

Now, the singleton intent of option b. could be expressed more clearly by either of the following variants:

(18) B: Is John there AND is Mary there? / Are (both) John and Mary there?

In contrast, it may not be possible to intonationally disambiguate (17) towards the intent of option a. For instance, the following does not suffice:

(19) B: Is JOHN there, and is MARY there?

Since themes tend to be closed under intersection (by the Reasonable Closure Principle), if the conjuncts are thematic then so is their conjunction. Hence, if the attentional intent of option a. is possible for (19), given the way accent placement constrains the theme, then the intent of option b. is possible too.

If indeed (19) is attentionally ambiguous, a rational speaker who intends to convey the intent of option a. ($\{^\wedge Pj, ^\wedge Pm\}$) will preferably do so unambiguously by uttering the disjunctive question in (16a) instead; and the intent of option b. ($\{^\wedge Pjm\}$) could be safely expressed by uttering (18). This predicts that (19) itself must serve a slightly different purpose, i.e., an "option c.". Having exhausted the single-intent options, a plausible third option could be that (19) is addressing two themes, with two separate attentional intents:

c. $\mathcal{A}_0 = \{^\wedge Pj\}$ and $\mathcal{A}_1 = \{^\wedge Pm\}$

That is, (19) may essentially ask two separate questions, one about John and one about Mary.

The derivation of this prediction, i.e., that (19) would be used with option c. because options a. and b. are more clearly expressed by other means, is tentative in several respects, but the prediction itself appears to be plausible. For instance, it agrees in outline with the understanding in Groenendijk and Stokhof 1984, according to which answering a conjunction of interrogatives would involve answering both conjuncts, and also with a rather different analysis in Krifka 2001b, according to which a conjunction of interrogatives would express two separate "speech acts". Moreover, it predicts, correctly to my understanding, that (19), does not imply that at most one of the two individuals is at the party, unlike an analysis in terms of option a. (and unlike its disjunctive variant, at least with falling intonation, see chapter 12). And an analysis of (19) in terms of option b. might have falsely predicted, depending on an account of accent placement, an implication that John is present if and only if Mary is (at least with falling intonation).

In sum, an analysis of (19) in terms of option c. appears to be plausible, and it may be forced on us by the attentional ambiguity of (19) and the fact that options a. and b. are easily unambiguously conveyed by other means. The attentional ambiguity of (19), recall, is a consequence of the fact that identifying the attentional intents of questions relies only on Manner-Conciseness, rather than the more restrictive fact 6.3. And this, in turn, is a consequence of the assumption that questions lack a main informational intent, and of trying to derive attentional intents pragmatically from a minimal notion of attentional content. In this way, the proposed, purely attentional treatment of questions may lead to a plausible treatment of conjunctive questions.

Constituent question Consider the following constituent question (where the questioned constituent is the syntactic object, because this brings out the interrogative mood more clearly, i.e., subject-auxiliary inversion):

(20) A: Whom (of John, Mary and Bill) did Sue see at the party?

$\mathcal{A}_0 = \{^\wedge S(s,j), ^\wedge S(s,m), ^\wedge S(s,b)\}^\cap$

To understand how this intent may be identified, we must decide what the semantic contents of constituent interrogatives are. However, this time we cannot simply take the contents from the corresponding declarative sentence, because it is not entirely clear what those contents would be. The declarative counterpart of (20) would be "Sue saw whom at the party.", which would not normally be uttered

(except echoically, with rising intonation, which may be an insightful data point, and compatible with what follows, but which I will here set aside).

Frege (1918) proposed to treat (20) as expressing an *incomplete* proposition. This was formalized for instance as $\lambda x\hat{}S(s,x)$ by Hausser 1980 (cf. Krifka 2001a). A closely related view is that (20) would express an *indeterminate* proposition, in the sense of Kuroda 1965, formalized for instance as $\hat{}S(s,x)$ in Berman 1991, and as a set of propositions $\{\hat{}S(s,j), \hat{}S(s,m), \hat{}S(s,b), \ldots\}$ in Kratzer and Shimoyama 2002. Another approach is to treat (20) as expressing a semantic "question", formalized as a set of propositions corresponding to the "basic" answers (Hamblin 1973; Karttunen 1977) or the exhaustive answers (i.e., a partition, Groenendijk and Stokhof 1984), but as I mentioned these approaches may semanticize what can potentially be pragmatically derived, and I will set them aside here. (However, these various approaches are intimately related: for instance, Groenendijk and Stokhof derive their partitions from "abstracts" like the objects of Hausser, e.g., $\lambda x\hat{}S(s,x)$; and at a purely technical level Hamblin or Karttunen's questions are no more complex than the proposition sets of Kratzer and Shimoyama.)

Regardless of whether (20) expresses an incomplete or an indeterminate proposition – supposing that these perspectives exhaust our options – the identification of its purported attentional intent must involve a form of impliciture, namely from an incomplete proposition to its possible completions, or from an indeterminate proposition to its possible instantiations. Such forms of impliciture would be quite like the sort of impliciture that I suggested earlier may occur in the case of an existential quantifier (i.e., example (10)), and it may be that a more precise account of Content Efficacy could predict its availability. But in the absence of such an account I must leave this as a mere suggestion.

6 Conclusion

I have shown how, by formulating a minimal notion of attentional content and taking into account Content Efficacy, the attentional intents for a relevant range of examples can be identified, though less definitively so for questions than for assertions. A central result is prediction 6.5: the attentional intents of explicit/literal assertions of disjunctive normal forms, given certain types of themes, normally contain all and only the informational contents of the disjuncts. Although only partial, the resulting characterization of attentional intents is sufficiently precise and general for the purposes of this dissertation. By deriving, in this way, attentional intents from a minimal notion of attentional content, we may get the notion of attentional intent essentially for free, including for instance its theme-dependence, contrary to more semantic approaches in the literature.

Part II

Intonational Compliance Marking

Chapter 7

Intonational Compliance Marking

> The error of attributing to syntax what belongs to semantics comes from concentrating on the commonplace.
>
> ("Bolinger's dictum", Ladd 1980, p.67, after Bolinger 1978a)

1 Introduction

Most results in the foregoing chapters relied on the assumption that the speaker of a given utterance took it to comply with the maxims. This assumption is stronger than the assumption of rationality, conceived of thus far as merely *trying one's best* to comply with the maxims, say, *maximizing expected compliance* (chapter 1, assumption 1.1). Most pragmatic explanations in the literature similarly start from the assumption of compliance with the maxims, which means that, unless the maxims are such that compliance with all of them is always possible, these explanations are incomplete. In chapter 4 the Manner submaxim of Compliance Transparency was already introduced to help mend this gap: a rational speaker will ensure that an audience is aware of whether the speaker takes her utterance to comply with the maxims or not. This raises the question of how speakers achieve this, e.g., by means of which linguistic signs compliance is indicated.

The current, second part of this dissertation provides a partial answer to that question with regard to speakers of English and related languages, by arguing that Compliance Transparency is standardly achieved through intonation, by means of *trailing tones* and *boundary tones* (in the phonological analysis of Gussenhoven 2004, to be introduced further below). I will refer to this account as a theory of *Intonational Compliance Marking* (ICM). This initial chapter introduces the ICM theory, applies it to a handful of examples and compares it to existing work, but only at a very general level. Chapter 8 provides an overview of the range of possible *clashes* in Attentional Pragmatics, which is needed for the ICM theory to generate more precise predictions: it helps determine which maxim

suspensions (i.e., possible or certain violations) may be responsible for a particular intonation contour. Subsequent chapters rely on this to provide detailed accounts of several phenomena: rising declaratives (or "declarative questions"; chapter 9), intonation on lists (chapter 10), rise-fall-rise intonation (chapter 11) and intonation on (interrogative) questions (chapter 12).

The ICM theory is similar in spirit to much existing work on intonational meaning; intonation has long been noted to serve a meta-pragmatic purpose. The main contribution of the ICM theory is that it offers a reasonably general account of intonational meaning, i.e., of the use and implications of many intonation contours on many types of utterances, while at the same time generating detailed, formally explicit predictions through its integration with Attentional Pragmatics. I will try to establish the accuracy or plausibility of these predictions primarily by means of a discussion of central examples, generalizations and occasional experimental findings from the literature.

Earlier versions of the ICM theory appeared in Westera 2013a and Westera 2014b. Although the current dissertation leaves the ICM theory essentially unchanged, the current framework of Epistemic Pragmatics enables a more explicit and conceptually cleaner formulation. Moreover, although this dissertation follows most of the suggestions given in the aforementioned publications regarding the treatment of rising declaratives, list intonation and the rise-fall-rise contour, this dissertation develops these mere suggestions into proper, detailed accounts, facilitated by its integration with an improved theory of Attentional Pragmatics.

Existing work on intonational meaning falls into two broad classes. On the one hand, what I will call "specialist" theories cover the use or implications of a narrow range of contours, or even only a particular type of use of those contours, but in considerable detail and often formal explicitness. These pertain for instance to certain uses of utterance-final rises on declarative sentences (e.g., Gunlogson 2003; Gunlogson 2008; Truckenbrodt 2006; Nilsenova 2006); accentuation and focus (e.g., Rooth 1985; Roberts 2012, among many); particular uses of rise-fall-rise (e.g., Ward and Hirschberg 1985; Büring 2003; Constant 2012); rises and falls in lists (e.g., Zimmermann 2000); and utterance-final rises and falls in questions (e.g., Roelofsen and Van Gool 2010; Biezma and Rawlins 2012).

On the other hand, what I will call "generalist" theories aim to cover a considerable range of intonation contours. This is often attempted by assigning basic morpheme-like meanings, like "(in)completeness" and "newness/givenness", to small phonological building blocks. These basic meanings then interface with a rich pragmatic theory to give rise to more precise implications for particular contours in particular contexts. Some examples are Gussenhoven 1984, Pierrehumbert and Hirschberg 1990, Bartels 1999 and Steedman 2014 (building on Steedman 1991; Steedman 2007). According to Ladd (2008, p.41), who calls the background assumption shared by these generalist approaches "the linguist's

theory of intonational meaning", linguists by and large agree that this type of approach to intonational meaning is on the right track. (Ladd contrasts this with the historical "instrumentalist" approach, which need not concern us here.)

Neither specialist theories nor current generalist theories are entirely satisfactory. Specialist theories are not entirely satisfactory, despite their precise, explicit and arguably mostly accurate predictions, because of their limited scope and therefore costly and (from the generalist's perspective) unexplanatory assumptions. Moreover, opinions may differ as to whether (a particular use of) a certain contour as modeled by a specialist theory even forms a coherent subclass that is worth analyzing in isolation. As a consequence, the aforementioned accounts can be criticized (and some have been, e.g., Gunlogson 2003 in Nilsenova 2006) for ignoring without proper justification certain examples that their theories cannot handle. Of course, this is not to say that specialist theories do not contain valuable insights and capture important descriptive generalizations – in this respect they set a high standard for more generalist accounts.

Generalist theories are unsatisfactory for the opposite reason: their broader scope comes at the cost of failing to yield precise predictions, perhaps to such an extent that they are not really falsifiable. As Ladd (2008) notes, this is because such theories rely on an underdeveloped pragmatics:

> [W]e know too little about pragmatic inference for the debate to be conclusive. On their own terms, analyses like Gussenhoven's, Steedman's or Hirschberg and Pierrehumbert's can all be evaluated as reasonably plausible – or reasonably implausible, depending on who is doing the evaluating. However, there is no theoretical framework within which we can undertake a comparative evaluation that would command general agreement.
>
> (Ladd 2008, p.150)

For instance, the claim that a particular accent would mark "selection from the common ground" (Gussenhoven, 1984) is difficult to falsify because there is no precise pragmatic theory that fixes under what conditions a rational speaker may select something from the common ground; and that a particular contour would signify "hearer agency in failing to suppose something to be common ground" (Steedman, 2014) is difficult to falsify because, again, there is no precise pragmatic theory that fixes the conditions under which this may occur. This is not to say, of course, that no such pragmatic theory could be developed – but until then, current generalist accounts of intonational meaning are insufficient.

The ICM theory of intonational meaning presented in this dissertation is generalist, at least as far as trailing tones and boundary tones go, but it generates precise predictions by virtue of its integration with Attentional Pragmatics, thereby avoiding Ladd's criticism. In the current chapter I will compare the ICM theory primarily to existing generalist accounts. Subsequent chapters will compare the

ICM theory in more detail to specialist accounts, one phenomenon at a time. As we will see, the ICM theory generates various aspects of existing proposals from more basic assumptions, retaining many of their insights while overcoming certain limitations.

Outline Section 2 presents a brief characterization of intonation and the phonological structure of English according to the analysis in Gussenhoven 2004, which I will adopt. Section 3 outlines the core of the ICM theory, i.e., the informational intents that I shall take the trailing tones and boundary tones to typically serve to convey. Section 4 clarifies the place of the ICM theory within the existing literature by comparing it to existing generalist accounts (leaving a comparison to specialist accounts to subsequent chapters) and by considering the "naturalness" of the assumed intents. Section 5 concludes and gives a brief overview of the remaining chapters of this dissertation.

2 Phonological assumptions (ToDI)

This chapter is about intonation in the sense of Ladd (2008), which has the following three characteristics:

- Intonation pertains only to *suprasegmental* features: fundamental frequency, intensity and duration. These features are "suprasegmental" in the sense that the values and changes in the values of these features typically persist over multiple *segments*, where a segment is the smallest, linearly orderable, discrete unit in phonetics, also called *phone*.

- The function of intonation is *post-lexical*, in that it does not serve to distinguish lexical entries from each other, but makes a difference only at the level of sentences or utterances. This *ex*cludes, for instance, lexical stress in English, and tone in tone languages like Standard Chinese.

- Intonation is *linguistically structured*: it is organized in terms of categorically distinct entities (e.g., accents, boundaries) and relations (e.g., louder than) that contribute categorically distinct pieces of information. Thus, a small difference in phonetic realization may give rise to a large, categorical difference in the information conveyed.

The latter excludes *paralinguistic* features, which are gradient: small differences in phonetic realization correspond to small differences in the information conveyed. An example of a paralinguistic feature is overall loudness, which correlates in a gradient way with the emotional activation of the speaker.

I will follow the common assumption that intonation contours in English and related languages are best analyzed as a series of phonological events, such as

"accents" and "boundaries". Pierrehumbert (1980), following Bolinger (1958), proposed an analysis of this sort for English, which lead to the development of the ToBI system ("Tones and Break Indices"; Silverman et al. 1992; Beckman, Hirschberg, and Shattuck-Hufnagel 2005). Selkirk (1984) proposed an analysis of this sort for German, and Gussenhoven (1988) for Dutch. The latter developed into the ToDI system ("Transcription of Dutch Intonation"; Gussenhoven, Rietveld, and Terken 1999; Gussenhoven 2005), and into an essentially isomorphic analysis of English in Gussenhoven 2004 (Gussenhoven (2005) also notes that the ToDI system can be applied to German and English). I will adopt Gussenhoven's analysis of English, which I will simply name after its Dutch counterpart ToDI.

I will first summarize the part of ToDI that is relevant for present purposes, and subsequently point out only briefly which features are omitted. For a more exhaustive overview and detailed motivation I refer to Gussenhoven 2004 (p.316 onwards) and Gussenhoven 2005, and for a more practical guide with many auditory examples (in Dutch) I refer to the ToDI website `http://todi.let.kun.nl/`.

ToDI (like ToBI) transcribes the intonation contour of a given utterance in terms of one or more *intonation phrases* (IP). Intonation phrases are separated by short pauses. For instance, a somewhat emphatic rendering of the following sentence could consist of three intonation phrases:

(1) $\overbrace{\underbrace{\text{John,}}_{\text{IP}}\ \underbrace{\text{who loves beans,}}_{\text{IP}}\ \underbrace{\text{envies Fred.}}_{\text{IP}}}^{\text{Utterance}}$

Each intonation phrase is a sequence of discrete events, namely *accents* and, at the start and end, *boundaries*, described in terms of high (H) and low (L) tones. The lowness or highness of tones is typically reflected by the fundamental frequency of the speech signal.

According to ToDI, though simplified for present purposes, an intonation phrase may consist of any number n of *pre-nuclear* accents, followed by a single *nuclear accent* and finally a boundary:

7.1. Assumption. **English intonation** (Gussenhoven 2004, simplified):

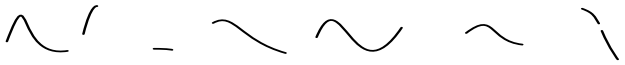
$$\textbf{IP} = \left\{ \begin{matrix} \text{(L)H*(L(H))} \\ \text{(L)L*(H)} \end{matrix} \right\}^{n} \quad \left\{ \begin{matrix} \text{(L)H*(L)} \\ \text{(L)L*(H)} \end{matrix} \right\} \quad \left\{ \begin{matrix} \text{H\%} \\ \text{L\%} \\ \text{\%} \end{matrix} \right\}$$

Accents can be high (H*) or low (L*), with optional high and/or low *trailing tones*, yielding, e.g., a falling accent H*L, or a fall-rising accent H*LH. Accents can also be *delayed*, by prefixing a low tone L and shifting the accent forward, for instance turning a falling accent H*L into a rise-falling accent L*HL. The right boundary of an intonation phrase can have a high (H%) or low (L%) tone,

or be toneless (%). ToDI is almost an *orthogonal* system, in the sense that any possible contour generated in accordance with assumption 7.1 is phonologically well-formed: Gussenhoven assumes only one constraint (for middle-class Southern British English), namely "no slump", which prohibits a low boundary after a rising accent, i.e., any contour ending in L*H L%.

As a first illustration of ToDI, one reasonably natural pronunciation of the utterance in (1) is given in (2):

(2) John, who loves beans, envies Fred.
H*L H% H*L H*L H% H*L H*L L%

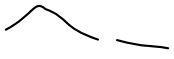


In addition to the ToDI transcription, a *pitch track* is shown of an audio recording of the utterance, pronounced in a way that accords with the transcription. The pitch track traces the relative fundamental frequency throughout the utterance. Although this is not the only phonologically relevant feature, and as such it underdetermines the ToDI transcription, it helps familiarize oneself with the relation between ToDI transcriptions and the sounds they transcribe. This and subsequent pitch tracks were extracted using the software *Praat* (Boersma, 1993) from an audio recording of my own pronunciation of the utterance, and then manually smoothened for reasons of presentation. I assume that my non-native pronunciation is sufficiently native-like to serve this merely illustrative purpose (and Dutch and English are intonationally very similar anyway); but my pronunciation will not be used as evidence in any sense.

Four features of ToDI have been omitted from assumption 7.1 because they will not be relevant for current purposes. I will briefly mention these further below. First I will discuss the relevant features in a bit more detail.

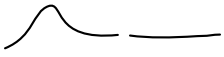
(Right) boundary tones There are three kinds of right boundaries: low (L%), high (H%), and level (%, the absence of a boundary tone). The following three utterances differ only in the right boundary:

(3) a. B: It's raining again.
H*L L%



b. B: It's raining again?!
H*L H%

c. B: It's raining again...
H*L %



What matters is not necessarily the absolute pitch level at which the utterance ends, but whether it keeps rising (H%) or falling (L%) until the very end, or stays more or less level (%).

Accents and trailing tones Accented words, regardless of the type of accent, tend to sound emphasized, more intense, and slightly lengthened compared to unaccented words. A typical way to strongly suggest a particular accent placement is by means of a preceding question, e.g.:

(4) A: Whom did John kiss?
B: John kissed Mary.
H*L L%

(5) A: Who kissed Mary?
B: John kissed Mary.
H*L L%

In these examples the accents are falling (H*L), i.e., high (H*) with a low trailing tone (L). In the following pitch tracks, the difference between a rising accent (L*H), a falling accent (H*L) and a level accent (H*) on "John" is clearly visible:

(6) A: Who kissed whom?

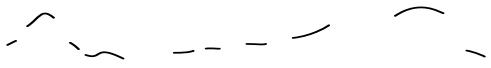
a. B: John kissed Mary.
H*L H*L L%

b. B: John kissed Mary...
L*H H*L L%

c. B: John kissed Mary.
H* H*L L%

Pre-nuclear accents can also have *two* trailing tones, resulting in the more complex fall-rising accent, as on "John" in the following:

(7) B: John will probably be at the party.
H*LH H*L L%



In each case, the tone marked by an asterisk in the transcription (e.g., H in H*L) is aligned to the lexically stressed syllable of the accented word. Example (7) furthermore shows also that the last trailing tone of an accent is reached only just prior to the next accent or boundary, a phenomenon called "tone linking".

Tone-linking Trailing tones of an accent (e.g., L, in H*L) do not necessarily immediately follow, but are reached through a gradual slope just before the next event (i.e., accent or boundary). This phenomenon, *tone linking*, becomes apparent if an accented syllable is followed by a longer stretch of unaccented material, such as "suddenly wanted to kiss" instead of "kissed" in the following examples:

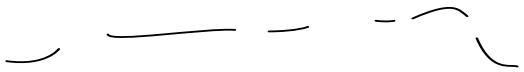
(8) A: Who suddenly wanted to kiss whom?

a. B: John suddenly wanted to kiss Mary.

H*L H*L L%

b. B: John suddenly wanted to kiss Mary...

L*H H*L L%



c. B: John suddenly wanted to kiss Mary?!

L*H L*H H%

In general, in order to find out whether an accent is rising, falling, or flat, it can be helpful to try to reproduce the utterance with some extra unaccented material after the accent.

Delay Accents can be *delayed*, a modification transcribed by prefixing "L" to the accent and shifting the "*" leftward (this leftward shift is not indicated in assumption 7.1). For instance, a falling accent (H*L) can be turned into a rise-falling accent (L*HL), creating more of a "scoop" towards the high tone. This is illustrated in (9a), compared to the variant in (3b) above, repeated here as (9b):

(9) a. B: It's raining again?!

L*HL H%

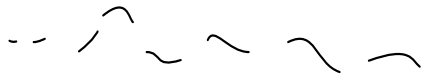
b. B: It's raining again?!

H*L H%

In (9a) the pitch maximum falls on "ing", whereas in (9b) it falls on "rain".

Four omitted features Four features of ToDI were omitted from assumption 7.1 because they will not be relevant for current purposes, but I will mention them here for the sake of completeness. First, intonation phrases have a boundary tone also at the start, which is typically low but can be high (often transcribed as "%L" and "%H"). Second, the nuclear accent of an intonation phrase can also have a *leading H*, i.e., a higher pitch right before the accent, but this is not very common (transcribed by prefixing "H+" to an accent). Third, high accents can be *downstepped* (transcribed as "!H*"), which means that any subsequent high tones will receive a lower pitch than the ones before. This is illustrated in the following, where a series of downsteps results in lower and lower high peaks:

(10) B: It was raining every single day.
H*L !H*L !H*L !H*L L%



Fourth, a special type of accent known as the "vocative chant" is omitted (transcribed as "H*!H"), which is used, for instance, when calling someone in a somewhat stylized way:

(11) B: John! Dinner time!
H*!H H*!H %

Ignoring these four features at present amounts to assuming that their semantic/pragmatic contributions will be orthogonal to those of trailing tones and right boundary tones, which are the main topic of this and subsequent chapters.

The foregoing summary of ToDI will be sufficient for the purposes of this dissertation. I will not include pitch tracks in the examples from now on, relying only on ToDI transcriptions and sometimes certain contextual cues to get the intended intonation contour across. For a more comprehensive overview of ToDI and detailed motivation I refer to Gussenhoven 2004; Gussenhoven 2005.

These works also contain a detailed comparison between ToDI and the better-known ToBI system, including (in Gussenhoven 2005) a translation key between ToDI and ToBI. I will here briefly highlight the main differences between ToDI and ToBI. One difference is that according to ToBI, but not ToDI, intonation phrases are always composed of "intermediate phrases" (Beckman and Pierrehumbert, 1986) with mandatory boundary tones that are, according to Gussenhoven (2004), not always phonologically relevant (see Wightman 2002 for similar criticism). As a consequence, ToDI transcriptions are considerably simpler. Another difference is that ToDI assumes fewer accent types than ToBI, where the latter arguably distinguishes more accent types than can be reliably identified by trained transcribers (e.g., between H* and "L+H*"; Syrdal and McGory 2000, as cited in

Steedman 2014). Lastly, ToDI does not transcribe so-called *break indices* (the "BI" in "ToBI"), i.e., the relative weight of pauses. One could, as Gussenhoven (2005) suggests, combine ToDI with a ToBI-style transcription of break indices, but this will not be necessary for current purposes (see Wagner 2010 for a recent account of interpretive effects of pauses).

The arguably unnecessary complexity of ToBI is one reason why I will formulate the ICM theory on the basis of ToDI – although the theory could in principle be formulated in terms of ToBI. Another reason is that the ICM theory is considerably more "natural" when framed in terms of ToDI, in a way that will be explained in section 4.

3 Intents for boundary tones and trailing tones

As announced, the current proposal pertains to two intonational features, namely (right) boundary tones and trailing tones. I will in this section explicate only the *intents* that I assume are typically conveyed by means of these intonational features, and postpone a discussion of their possible semantic *contents* to section 4.

3.1 Boundary tones

For the boundary tones I assume the following informational intents:

7.2. Assumption. **Intents of right boundary tones**

- L%: the utterance thus far (i.e., up to this boundary) is believed by the speaker to comply with the (applicable) maxims relative to the main theme $\mathcal{T}_0$.

  $^{\wedge}\Box\,\textsc{Maxims}(\mathcal{T}_0)$ (in an utterance model of the utterance *thus far*)

- H%: the utterance thus far is not believed by the speaker to comply with the (applicable) maxims relative to the main theme $\mathcal{T}_0$.

  $^{\wedge}\neg\Box\,\textsc{Maxims}(\mathcal{T}_0)$ (in an utterance model of the utterance *thus far*)

(As attentional intents I assume the singleton sets containing the informational intents, in line with chapter 6 – but these will not really play a role.) Recall from chapter 3, definition 2.13, that an utterance complies with the maxims relative to a theme ($\textsc{Maxims}(\mathcal{T})$) if and only if there exists an informational intent that complies with all the I-maxims relative to the theme, an attentional intent that complies with all the A-maxims relative to the theme, and the utterance as a whole complies with Manner. In chapter 12 on question intonation I will allow for a more flexible interpretation of $\textsc{Maxims}(\mathcal{T})$, so that different sets of maxims may

apply to different types of utterances and compliance marking will take this into account – this is anticipated by the parenthesized "applicable" in the informal paraphrases in assumption 7.2, but it will not play a role until then.

Assumption 7.2 may already appear quite promising. For instance, in some circumstances a final rising pitch in English can signal that the speaker considers the proposition expressed to be merely likely (example from Gunlogson, 2003, my transcription):

(12) *(B sees A enter the room with an umbrella.)*
B: It's raining?
H* H%

This lack of commitment, in Gunlogson's terms, could perhaps be analyzed as a suspension of I-Quality – indeed, this type of analysis will be pursued in chapter 9. The same words uttered with a "rise-fall-rise" intonation contour are more naturally taken to signal that the speaker is uncertain about the relevance of her utterance (comparable examples are reported in Ward and Hirschberg, 1985):

(13) A: Is John at the party?
B: (Well,) it's raining...
L*HL H%

Superficially at least, the "uncertain relevance" implication might be due to a suspension of the maxims of I/A-Relation – although we will see in chapter 11 that the origin of this implication is slightly more complex. Some other examples in which maxims are potentially compromised are the following ((14) is discussed in Pierrehumbert 1980, my transcription; (15) is a constructed example from Westera 2013a; (16) is from Malamud and Stephenson 2015):

(14) M.L.: *(to a receptionist)* Hello, my name is Mark Liberman.
H* H%

(15) *(English tourist in a French café.)*
A: I'd like... err... je veux... a black coffee?
H* H%

(16) *(A isn't sure if B wants to know about neighborliness or suitability for dating.)*
B: What do you think of your new neighbor?
A: He's attractive?
H* H%

In (14), the speaker is arguably suspending I/A-Quantity: he is unsure whether his name alone is sufficient for the receptionist to be able to help him (or perhaps he feigns this for reasons of politeness). In (15) the suspended maxim is plausibly I/A-Clarity: the tourist is unsure whether he made himself understood. In (16) the suspended maxim could be I/A-Relation, perhaps together with I/A-Quantity.

Of course, this is only a first sketch – a more convincing analysis for each of these examples would consist at the very least of an explanation of why that maxim is to blame rather than any other, how an addressee might figure this out, and why the speaker risked violating the maxim to begin with, rather than, say, address a different theme.

Two clarifying remarks. First, assumption 7.2 presupposes that there is only one main theme, i.e., one theme with maximal precedence, namely $\mathcal{T}_0$. This might be a simplification: in chapter 6 we ran into an example (the conjunction of disjunctions in (7)) which arguably involved two main themes, obtained by theme-pragmatically splitting the prior theme into two. For an adequate account of such examples, assumption 7.2 could be refined as follows: the low boundary would indicate intended compliance relative to *all* main themes, and the high boundary its negation, i.e., potential non-compliance relative to *some* main theme. The reason for not allowing multiple main themes in assumption 7.2 is that otherwise its formalization would require a formal definition of main theme, and hence a formalization of the relative precedence of themes, which is a theme-pragmatic matter the formalization of which lies outside the intended scope of this dissertation. Fortunately the restriction to single main themes will be harmless for the examples to be considered in this and subsequent chapters.

Second, according to assumption 7.2 different boundary tones indicate the (non-)compliance of different parts of the utterance (and the same will hold for trailing tones in different intonation phrases, as we will see further below). As a consequence, we cannot jointly represent the intents contributed by different boundary tones of an utterance in a single utterance model. The reason is that there are no entities within an utterance model that represent utterances or their parts; an utterance model in its entirety just represents one (part of an) utterance. This representational poverty is self-imposed, primarily for reasons of simplicity – it avoids having to add an extra argument or index to all maxim constants, as well as the constants for themes, intents and contents – but also because, therapeutically, it helps enforce a speaker-centered view (chapter 2). Most examples to be discussed will contain just a single intonation phrase, so this representational poverty will not matter. However, primarily in chapter 10 on list intonation we will consider utterances consisting of multiple intonation phrases. There I will slightly enrich the formalism from part I, moving from *utterance models* to *dynamic utterance models*, in order to be able to represent and reason about the intonationally conveyed intents of utterances with multiple intonation phrases within a single model.

3.2 Trailing tones

I assume that trailing tones indicate (non-)compliance much like the boundary tones just discussed. However, where boundary tones indicate compliance relative

to the main theme, trailing tones indicate compliance (typically) relative to a theme that is, in some sense to be clarified, *responsible* for the accent. Before making this more precise, I must first clarify in what sense a theme can be responsible for an accent, by saying a bit about the meaning of accentuation as such, i.e., regardless of trailing tones. I do not intend to contribute anything new in this respect; the novelty of my proposal will be restricted to the trailing tones.

With regard to accentuation, regardless of trailing tone, the following assumption is intended to be so vague as to be compatible in principle with most existing proposals:

7.3. Assumption. By means of accentuation a speaker indicates the importance of the accented word/syllable.

(Note that this does not imply that every important word/syllable must be accented.) Whether a particular word or syllable is important, or important enough for it to be accented, has been noted to depend on something like its *predictability* given other words in the same utterance (Bolinger, 1972), given the preceding discourse (Schwarzschild, 1999; Büring, 2006), and given something like the theme addressed (Rooth, 1992; Roberts, 2012; Beaver and Clark, 2009). Roughly, the less predictable a word is, the more likely it is to be accented (Beaver and Velleman, 2011), though additional syntactic or prosodic (e.g., rhythmic) preferences may favor some accent placements more than others (e.g., Gussenhoven, 1983; Selkirk, 1995; Büring, 2006).

For the purposes of this dissertation we can set most of the complexity surrounding accent placement aside. My proposal regarding the contribution of trailing tones will rely only on the general idea that themes may affect the importance and hence accentuation of words. This was already illustrated by (4) and (5) above, repeated here as (17a,b):

(17) a. A: Whom did John kiss?
B: John kissed *Mary*.
H*L L%

b. A: Who kissed Mary?
B: *John* kissed Mary.
H*L L%

Intuitively, the reason why (17a) has an accent on "Mary" is that, given the theme it addresses (i.e., given A's preceding question and the Continuity Principle), it is the most unpredictable word: it is what distinguishes B's answer from other basic ways in which she could have rationally addressed the theme (at least if her knowledge about whom John kissed had been different). In (17b) the accent on "John" can be explained in a similar way. The following assumption generalizes this type of explanation:

7.4. Assumption. Given an utterance of a sentence containing a word/syllable σ, a theme $\mathcal{T}$ of the utterance *contributes to the importance of* σ if the uttered sentence differs at least in σ from some other basic (e.g., simple, compliant) way(s) of addressing $\mathcal{T}$.

I may in that case say that the theme *makes* the word important, or that the word is important *due to* the theme.

Assumption 7.4 is potentially as complex as rheme-pragmatics as a whole, a complexity that resides in the "basic way(s)" of addressing a theme. Moreover, it says nothing about the various other factors that may make a word (un-) important, or about additional syntactic or prosodic preferences, and hence only very little about accent placement. But we may expect at least some words that are important due to a theme of the utterance to be accented and at least some words that are accented to be important due to a theme. This coarse, partial characterization of the relation between accents and themes will be sufficient for the purposes of this dissertation. In section 4 I will briefly discuss existing accounts of accent placement that are based on the notion of "focus".

As I announced, the new part of my proposal pertains not to accentuation as such, but to the trailing tones (which in isolation I will denote by "-L" and "-H"). I assume that these serve to indicate whether the speaker takes the utterance to comply with the maxims, but, unlike the boundary tones, not necessarily relative to the main theme but relative to some theme due to which the accented word is important. When discussing a given utterance, because I will not formalize the relation between themes, importance and accent placement, I will simply assume particular themes on a case by case basis and formulate the intents of trailing tones in terms of particular theme constants $\mathcal{T}_i$, as follows:

7.5. Assumption. **Intents conveyed by means of trailing tones**

- -L: according to the speaker, the utterance up to the first subsequent boundary tone (not %) complies with the (applicable) maxims, relative to a certain theme $\mathcal{T}_i$ due to which the accented word was important.

  $^\Box$Maxims$(\mathcal{T}_i)$ (in an utterance model up to the next H%/L%)

- -H: according to the speaker, the utterance up to the first subsequent boundary tone (not %) potentially does not comply with the (applicable) maxims, relative to a certain theme $\mathcal{T}_i$ due to which the accented word was important.

  $^\neg\Box$Maxims$(\mathcal{T}_i)$ (in an utterance model up to the next H%/L%)

Except for the potentially different theme, these intents are equivalent to those for the boundary tones.

To illustrate, let us consider the following example:

(18) A: Who did John kiss?
B: John kissed Mary...
L*H H*L L%

Before exploring the predictions of the ICM theory, let's say that, intuitively, B's response with the given intonation contour can at least in certain circumstances be roughly paraphrased as follows:

(19) Well, John kissed Mary (and no one else), but perhaps other people have relevantly kissed as well.

In other words, B's utterance in (18) seems to resolve A's question of whom John kissed, while evoking the broader question of who kissed whom (Büring (2014) would call John a "purely implicational topic"). In what follows I will explain how the ICM theory could potentially predict this, though only briefly, for the sake of illustration, leaving many important issues untouched.

The informational intents for B's utterance in (18) are as follows, where p_3, p_4 and p_5 are predicted by the ICM theory to be conveyed by the intonational features given:

$p_0 = {}^\wedge K(j, m)$
L%: $p_3 = {}^\wedge\Box\,\textsc{Maxims}(\mathcal{T}_0)$
-H: $p_4 = {}^\wedge\neg\Box\,\textsc{Maxims}(\mathcal{T}_1)$ ($\mathcal{T}_1$ makes "John" important)
-L: $p_5 = {}^\wedge\Box\,\textsc{Maxims}(\mathcal{T}_2)$ ($\mathcal{T}_2$ makes "Mary" important)

The names p_3, p_4 and p_5 are chosen somewhat arbitrarily, their indices reflecting only that they are not the most prominent intents.

Given these intents, we can infer that the theme denoted by $\mathcal{T}_1$ must be different from the theme(s) denoted by $\mathcal{T}_0$ and $\mathcal{T}_2$, because an utterance cannot both comply and not comply relative to the same theme. The themes denoted by $\mathcal{T}_0$ and $\mathcal{T}_2$, in contrast, may well be one and the same. Indeed, let us assume that $\mathcal{T}_0 = \mathcal{T}_2$, so that B's utterance addresses only two themes. Given the Continuity Principle, it seems reasonable to assume that the main theme $\mathcal{T}_0$ (= $\mathcal{T}_2$) is inherited from A's initiative, i.e., that it is the theme of whom John kissed – this is also compatible with the theme making "Mary" important. The other theme ($\mathcal{T}_1$) should make "John" important, and a plausible theme may be that of who kissed whom – plausible, at least, if a theme-pragmatic principle could be motivated to the effect that speakers may in certain circumstances *broaden* a prior theme. In sum, let us assume the following combination of themes:

$\mathcal{T}_0 = \mathcal{T}_2 = \{^\wedge K(j,j), ^\wedge K(j,m), ^\wedge K(j,b)\}^\cap$ ("whom did John kiss?")
$\mathcal{T}_1 = \{^\wedge K(j,j), ^\wedge K(j,m), \ldots, ^\wedge K(b,m), ^\wedge K(b,b)\}^\cap$ ("who kissed whom?")

Supposing that these assumptions are correct, the intents predicted for (18) imply that the theme of A's question ($\mathcal{T}_0$) is knowingly compliantly addressed while the broader theme of who kissed whom ($\mathcal{T}_1$) is not. The former predicts the exhaustivity implication that John didn't kiss anyone else, through A-Quantity; the latter may predict a non-exhaustivity implication, i.e., that there may have been other relevant kissing events, provided the potential non-compliance relative to $\mathcal{T}_1$ can be blamed on an A-Quantity suspension. Altogether, these predictions would correspond to the paraphrase in (19).

Note that the above choice of themes means that intents p_4 and p_5 are in fact one and the same, hence the low trailing tone and the low boundary tone both serve to convey the same intent (although the low trailing tone in addition provides information about the nature of the theme, through the placement of the accent, but this is not formalized). Moreover, for the sake of completeness, note that there must be appropriate themes for the intents p_3 and p_4 ($= p_5$) to address. These themes can be as follows:

$\mathcal{T}_3 = \{^\wedge\Box\,\textsc{Maxims}(\mathcal{T}_0), ^\wedge\neg\Box\,\textsc{Maxims}(\mathcal{T}_0)\}$
$\mathcal{T}_4 = \{^\wedge\Box\,\textsc{Maxims}(\mathcal{T}_1), ^\wedge\neg\Box\,\textsc{Maxims}(\mathcal{T}_1)\}$

Such themes are evoked by the maxim of Compliance Transparency, via the theme-pragmatic Clarification Principle, as explained in chapter 4.

Of course the analysis sketched here is incomplete in important respects – it is intended only as a first illustration. Although in this dissertation I will not give a more detailed account of examples like (18), the sorts of considerations required for that type of intonation contour, i.e., contours containing mixed trailing tones, closely resemble those required for the rise-fall-rise contour, which will be discussed in detail in chapter 11.

The foregoing shows that in order to understand a given intonation contour within the ICM theory, we may need both theme-pragmatics, for an understanding of the (combinations of) themes that may be addressed, and rheme-pragmatics, for an understanding of which maxims may be suspended or violated. As announced earlier, chapter 8 will serve to increase our understanding of the latter; and subsequent chapters will rely on this, and on theme-pragmatics, in various ways, to generate detailed predictions for numerous intonation contours.

4 Place within the literature

This section comprises five subsections. Section 4.1 compares the ICM theory to existing work on the purported contents or intents of boundary tones and trailing

tones. As announced, the comparison will be restricted to generalist accounts, leaving a discussion of specialist accounts to subsequent chapters. Section 4.2 highlights the compatibility of the current approach with accounts of accent placement based on the notion of "focus". Section 4.3 considers what the contents of the intonational features may be like (thus far I have talked only about the intents they would serve to convey) and relates this to considerations of compositionality. Section 4.4 relates the assumed intents of trailing tones and boundary tones to the "natural meaning" of intonation (Gussenhoven 2002). Section 4.5 explains how an adequate theory of intonational meaning may inform theories of intonational phonology (like ToDI or ToBI).

4.1 Existing accounts of intonational meaning

The assumed intents of boundary tones seem to me in line with much existing work (though recall Ladd's (2008) criticism that the predictions of most generalist accounts are too vague to tell with certainty). For instance, Imai (1998) proposes that a final rising pitch would indicate a suspension of judgment about some aspect of the utterance; Gunlogson (2008) proposes that a final rising pitch indicates that the utterance is *contingent*, i.e., that its effects on the common ground depend on some subsequent discourse move (her approach will be discussed in chapter 9); Malamud and Stephenson (2015) propose that the final rising pitch serves to raise a "metalinguistic issue" about some aspect of the utterance. Slightly more vaguely, high right boundary tones are commonly taken to indicate that the utterance is "unfinished", "forward-looking" or "continuation-dependent" (e.g., Bolinger, 1982; Pierrehumbert and Hirschberg, 1990; Bartels, 1999; Lai, 2012). In effect, assumption 7.2 just makes these existing proposals more precise: through Attentional Pragmatics, it spells out the ways in which an utterance may relevantly count as unfinished, forward-looking, contingent and so on, namely as potentially non-compliant with the rheme-pragmatic maxims. Note that this is not a vacuous restriction: it rules out, for instance, that high right boundary tones would indicate the suspension of a *theme*-pragmatic principle, or that low right boundary tones would indicate the complete resolution of the theme (which would falsely predict that genuine questions cannot end with a low boundary tone).

If we take also the trailing tones into consideration, the current approach is quite similar to a proposal by Hobbs (1990), which is an attempt to streamline the account in Pierrehumbert and Hirschberg 1990. Hobbs treats both high trailing tones and high right boundary tones as signaling incompleteness (or rather, as not signaling completeness) of the morpheme or phrase on which it occurs. By incompleteness of a morpheme or phrase, Hobbs means that the information contributed by that part of the utterance – roughly, the existential closure of its ordinary meaning – requires further discussion before it can become common ground. Hobbs's proposal shares with the current account a parallelism between trailing tones and boundary tones, and incompleteness and non-compliance are

also similar in spirit. But an important difference is that Hobbs takes boundary tones and trailing tones to mark *different parts* of the utterance as (in)complete, whereas I assumed that boundary tones and trailing tones (in the same intonation phrase) mark *the same part* of an utterance as (in-)complete (or (non-)compliant), but *in different respects*, i.e., relative to potentially different themes.

The current approach is also similar to the account in Gussenhoven 1984. Gussenhoven notes that specifying (by means of accent placement) which part of the utterance is the main contribution is not enough: the speaker must also "specify what relationship exists between contribution and background" (p.201). I have basically made this relation precise in terms of compliance with the maxims relative to a theme. Gussenhoven instead distinguishes *addition* of the contribution to the background, *selection* of the contribution from the background, and *testing* whether it belongs to the background, and proposes that these are expressed by the fall (H*L or H*L L%), the fall-rise (H*LH or H*L H%) and the rise (L*H or L*H H%) respectively. The addition/testing distinction can potentially be derived from the current approach (though not necessarily vice versa): a consequence of compliance with the maxims is typically that the intent is added to the common ground, and a consequence of (potential) non-compliance is that something remains to be resolved, typically by the addressee, before the conversational goals are achieved. Moreover, Gussenhoven associates the absence of a boundary tone (i.e., %) with the utterance's being expected or *routine* (in line with Ladd 1978), which is arguably a type of circumstance in which compliance marking is unnecessary and in which, hence, the ICM theory leads us to expect no boundary tone. Gussenhoven's account of fall-rise in terms of selection does not follow as directly from the current account, but this will be discussed in chapter 11.

Lastly, Steedman (2014) proposes a theory that is compositional in a way that ICM and the other accounts are not, i.e., according to him the contributions of the various components of an intonation contour do not merely accumulate into a big set of intents, but interact. He assigns meanings to accents on the basis of two dimensions: whether material conveyed by the accented phrase is thematic, i.e., supposed to be given/common ground, or rhematic, i.e., intended to update the common ground; and whether this supposition or update is successful or unsuccessful. Within the space defined by these two binary distinctions, Steedman locates the ToBI accents as follows (adopted from Steedman 2014; there adapted from Steedman 2007):

	success	failure
thematic (suppose)	L+H*	L*+H
rhematic (update)	H*, H*+L	L*, H+L*

(ToDI does not draw all of these distinctions, and also casts doubt on Steedman's precise division of this space from another angle; see further below.) Steedman intends his distinction between the rows (thematic and rhematic) to be reminiscent of Gussenhoven's distinction between selection and addition. On top of this, he

assumes that the boundary tones signal speaker agency (L%) or hearer agency (H%) in whatever it is that the accents indicate. In this way boundary tones and accents work together to convey quite complex propositions, e.g., that the hearer fails to suppose that the accented material is common ground, or that the speaker succeeds to make the accented material common ground. The compositionality of Steedman's account means that we cannot compare it to the ICM theory for each individual intonational feature; we can only compare the predictions of the two theories with regard to entire intonation contours, as I will do primarily with regard to on rise-fall-rise intonation, in chapter 11.

4.2 Focus-based accounts of accent placement

Although the ICM theory is not a theory of accent placement, it does rely on the assumption that at least some accents occur on words that are in some sense important due to a theme – at least those accents that have trailing tones (although this could perhaps be weakened if necessary, see further below). In order to highlight the compatibility of this assumption with existing accounts of accent placement, and also for the sake of concreteness, I will summarize a common line of approaches to the relation between accent placement and something like themes, namely those based on the technical notion of *focus* (e.g., Rooth 1992; Selkirk 1995; Schwarzschild 1999; Büring 2006). (I will not discuss the large body of earlier work on accent placement that employed a notion of focus in much the same way but without (explicitly) conceiving of focus in terms of something like themes, e.g., Gussenhoven 1983, among many.)

As a first approximation, in responses to "wh"-questions, the focus is what takes the place, as it were, of the "wh"-word in the question. To illustrate, consider again the contrast in (17) above, repeated here:

(17) a. A: Whom did John kiss?
B: John kissed *Mary*.
H*L L%

b. A: Who kissed Mary?
B: *John* kissed Mary.
H*L L%

In (17a) the focus is simply the accented name "Mary", and in (17b) it is the name "John" – but a focus can also be a larger constituent that can take the place of the "wh" word, e.g., "Mary's brother's best friend". (Gussenhoven (1984, , p.15) argues that focus is better understood as a *semantic* constituent, in some sense, but the difference will not be important for current purposes.) By replacing the focus of an uttered sentence by alternatives, we can obtain all the basic responses to the theme and hence, by collecting their direct informational intents (or, for literal utterances, their informational contents), all the propositions in the theme.

For instance, in (17b) we can replace "John" by the names of other relevant individuals to obtain alternative sentences: "Bill kissed Mary", "Sue kissed Mary", and so on. The direct informational intents of these alternative sentences, when (hypothetically) uttered, are propositions of the theme.

More generally, the foci (plural) of an utterance can be characterized in terms of a theme, as the *maximal* constituents that one *must* be permitted to replace in order to be able to obtain, by choosing the right replacements, all other basic responses to (and thereby propositions of) the same theme. The alternative utterances or propositions that can be obtained by replacing the foci are commonly called "focus alternatives", and the relationship between focus alternatives and themes is typically captured in a "Focus (Interpretation) Principle" (e.g., Rooth, 1992; Roberts, 2012; Beaver and Clark, 2009). The essence of a Focus Principle is that the theme should be a subset of the set of focus alternatives. This constrains the relation between theme and focus. An account of the relation between theme and accent placement can now be obtained by constraining which words in a focus may or must contain accents (or, vice versa, which constituents containing an accent may be foci).

Constraints on the relation between focus and accent placement are typically captured in rules of "focus projection". For instance, Selkirk (1995) proposes such rules that state (roughly) that every focus must contain an accent somewhere in a right-most syntactic branch; Schwarzschild (1999) and Büring (2006) criticize Selkirk's account and argue that the relation between focus and accent is not primarily constrained syntactically but semantically/pragmatically: a focus must contain an accent somewhere, and basically anywhere, though preferably not on material that is *given* (or, slightly more generally, *predictable*; Beaver and Velleman 2011). According to Büring (2006) accent placement is in addition governed by rules of *default prominence*, much in line with the arguments by Ladd (2008, chapter 7) that accent placement within a focus would be guided by considerations of *metrical structure*. German, Pierrehumbert, and Kaufmann (2006), following Ladd 1980, add to Schwarzschild's account the inherent lesser accentability of certain word classes.

All of this is compatible in principle with the current proposal, i.e., the assumptions given earlier. Assumption 7.3 states that accents indicate that words are important, but nothing is said about which important words should be accented, a matter which may well be subject to, say, givenness constraints or rules of default prominence. Assumption 7.4 effectively states that a theme makes a word important if and only if the word is contained in a focus for that theme. And assumption 7.5 states that the trailing tones of a given accent indicate (non-)compliance relative to some theme such that the accented word is contained in a focus for that theme. These assumptions say nothing about where in a focus the accent should go, as no such precision is necessary for present purposes, i.e., for a detailed account of the phenomena that will be discussed in subsequent chapters. In the future, in order to obtain precise predictions with regard to more

complex utterances, in particular those with multiple rising/falling accents within an intonation phrase, in principle one of the aforementioned accounts of accent placement could be plugged in.

Although the ICM theory is compatible with focus-based accounts of accent placement, it would not be the happiest marriage. Schwarzschild (1999) criticizes the focus projection rules of such accounts (including his own) for being "opaque" (p.175), and sketches an alternative that is more in line with the current approach to intonational meaning:

> This state of affairs is forced on us by the decision to insulate the semantics and the phonology from each other, allowing them to talk only via the syntax. [...] As Gussenhoven (1984), Pierrehumbert and Hirschberg (1990) and others contend, accents are meaningful. [That some accents are incompatible with givenness] should therefore just follow from the meaning of the accents in question and the information status of the words they are attached to.
>
> (Schwarzschild 1999, p.99)

Schwarzschild's criticism resembles earlier criticism of "syntactic determinism" in this area by Ladd (1980, pp.95–99) and Bolinger (1978a). In part because of these criticisms I formulated assumptions 7.3, 7.4 and 7.5 without reference to the notion of focus. I hope that this will invite a future account of accent placement that, in line with Schwarzschild's suggestion, will consist in (i) spelling out what accentuation means (which by assumption 7.3 amounts to defining when a word is "important"), and (ii) stating in detail when that meaning is worth sharing (i.e., when the importance of a word is thematic). But as I hope to have explained, nothing in the current dissertation hinges on whether such a theory can be developed and what exactly it will look like. (A possible objection to such an attempt may be the common assumption that something like the set of focus alternatives of an utterance should be accessible in the compositional computation of the semantic content. This will be discussed next.)

4.3 Contents and compositionality

I have said nothing yet about the semantic contents of trailing tones and boundary tones, only about the intents that their contents must somehow serve to clearly convey. Contents will not play a crucial role in subsequent chapters either, where predictions will be generated directly from the assumed intents. Nevertheless, a brief excursion in this section to the level of semantic contents will yield some further insight into the ICM theory and how it relates to existing work.

According to the ICM theory, trailing tones and boundary tones convey their own separate intents. A straightforward semantics would therefore consist in

likewise assigning separate informational contents to these individual features. Just like the intents, the contents would not really interact but merely accumulate into one big set. According to such a semantics a sentence with n intonational features would have at least n informational contents, each of which would (through the maxim of Content Efficacy, chapter 4) serve the communication of some intent – though different contents may in principle contribute to conveying the same intent, as was arguably the case in example (18) given earlier. Such a semantics would be compositional in one sense, but not in another – and perhaps the same could be said about the level of intents or about the ICM theory as a whole. It is compositional in the sense that the contents of (or intents conveyed by) any given intonation contour will be determined by the contents of (or intents conveyed by) its parts. But it is non-compositional in the sense that the contributions of the parts do not interact to form bigger units – rather, they just accumulate into one big set.

To my understanding, most existing generalist accounts are compositional and non-compositional in these senses (e.g., Gussenhoven, 1984; Pierrehumbert and Hirschberg, 1990; Bartels, 1999), and it seems to me the favored type of semantics also for the ICM theory – although it is not committed to it. I will briefly dispel two possible objections to this non-compositional type of semantics: (i) that the compositional semantic computation of the main informational content of a sentence should have access to intonational meaning; and vice versa (ii) that intonational meaning should have access to the compositionally computed main informational content of (parts of) the sentence. Both objections could seem to favor a more compositional semantics of intonation (e.g., along the lines of Steedman 2014).

Objection (i) derives from the common assumption in focus-based accounts of accent placement that something like the set of focus alternatives of an utterance would constitute a separate dimension of semantic content, computed compositionally, to which the computation of the ordinary semantic content may occasionally have access. This assumption is originally due to Rooth's (1985) account of the apparent "focus-sensitivity" of words like "only", i.e., that differences in accent placement in the scope of "only" appear to lead to differences in (intuitive) truth conditions:

(20) a. John only introduced Mary to Sue.
H*L L%

b. John only introduced Mary to Sue.
H*L L%

According to (20a) John introduced no one else to Sue, whereas according to (20b) he introduced Mary to no one else. However, Beaver and Clark (2009) argue that we should conceive of focus-sensitivity not as accent-sensitivity, but as *theme*-sensitivity: the semantics of "only" would be directly sensitive not to accentuation or something like focus alternatives, but to the theme of the utterance,

and hence to accentuation only indirectly by virtue of the relation between the theme and accent placement. (Similarly, recall from chapter 6 that I accounted for the attentional intents of disjunctions with different accentuations in terms of theme-dependence, not accent-dependence.) Although Beaver and Clark still happen to rely on compositionally computed focus alternatives for constraining the relation between accent placement and themes (via their Focus Principle), their core argument is that we do not need to assume that the compositional computation of the main informational content would have access to it. And once this is acknowledged, nothing prevents us from conceiving of focus alternatives themselves as not a separate type of semantic content, but as a particular, perhaps somewhat simplistic way of describing the meaning of accentuation, i.e., as a starting point for the type of account that Schwarzschild (1999) invites us to pursue.

Objection (ii) – that intonational meaning should have access to the compositionally computed main informational content of (parts of) the sentence – may be fed for instance by the fact that the meaning of an accent seems to depend on its precise location in the sentence. Indeed, this is an assumption also of the ICM theory: a trailing tone indicates compliance relative to the theme that made the accented word important. But this structure-dependence of the meaning of accents does not in fact require a fully compositional semantics of intonational meaning. After all, an alternative approach is to say that accents semantically refer to the linguistic expressions on which they occur, essentially a form of *deixis*, just like "this sentence" may refer to the sentence in which it occurs, and "I" may refer to the speaker of the utterance. Indeed, this seems to me the most direct implementation of the intuitive idea that an accent basically means "this word here is important!". The meaning of an accent would be sensitive to the syntactic structure simply because the word to which it refers happens to occur in a particular syntactic structure, and because whether a word is important may depend on its syntactic context. Analogously, consider the predicate "has six words" in the following utterance:

(21) A: That sentence on the blackboard over there has six words.

The predicate "has six words" (and similarly, say, "has declarative mood" or "has a direct object") can be sensitive to the syntactic structure of the sentence it takes as an argument, i.e., that sentence on the blackboard over there, without the syntactic structure of that sentence being a component of the syntactic structure of the sentence uttered by A.

The foregoing remarks are intended not as arguments in favor of the non-compositional type of semantics that the ICM theory suggests we explore, but only as arguments against two possible objections to such a semantics. For the purposes of this dissertation, the question of which type of semantics is possible and the most useful as a semantic backbone of the ICM theory can be safely left to future work.

4.4 Relation to natural meaning

Intonational meaning has been noted to be non-arbitrary to a considerable degree (e.g., Bolinger, 1985; Gussenhoven, 2002). This non-arbitrariness is quite intuitive – e.g., it wouldn't intuitively "make sense" to pronounce important words with a *lower* intensity – but more reliably it is suggested by certain pervasive (though not exceptionless) cross-linguistic regularities, for instance that questions tend to end with a higher pitch than assertions. Gussenhoven (2002) proposes to explain this non-arbitrariness in terms of our biological make-up. For instance, a high pitch is indicative of high lung pressure, a state of affairs that tends not to obtain near the end of an utterance, where we run low on breath. Because of this biological fact, Gussenhoven argues, the high pitch *naturally* means that the utterance is unfinished or ongoing (cf. Grice's (1989, ch.14) "natural meaning"). He calls such natural regularities "biological codes", and the code that associates high pitch with unfinishedness the "Production Code".

Ideally, in line with the heuristic of convention minimalism (chapter 1), one would explain all of intonational meaning in terms of natural meaning. In our case this would amount to deriving, in some sense, the intents that the ICM theory assigns to trailing tones and boundary tones from their natural meanings. Gussenhoven conceives of this derivation in a diachronic way, in terms of language change: intonational meaning would be the result of gradual *grammaticalization* (conventionalization) of the biological codes, over the course of many generations. But the distinction between contents and intents creates another locus for such an explanation: perhaps we can equate the semantic contents of intonational features with their natural meanings, and "derive" the intents from these pragmatically, as a form of impliciture (chapter 4). Put differently, the natural meanings may suffice for clearly conveying the assumed intents, in which case no more sophisticated semantic contents would be necessary. (See Bergen and Goodman 2015 for a simple attempt in this direction with regard to accent placement and "focus".)

Depending on how the labor is divided between diachronic language change and pragmatic impliciture, the semantic contents of intonational features may in principle lie anywhere in between their natural meanings and the assumed intents. This is depicted in figure 7.1. Gussenhoven's (population-level, diachronic) grammaticalization would account for the relation between natural meaning and the semantic contents, and (speaker-level) impliciture would explain any remaining discrepancy between the semantic contents and the assumed intents.

It is not always clear where the rationality of an individual speaker ends and the diachronically accumulated biases of a population begin (cf. chapter 1, section 3.3). In what follows I will primarily explore a purely pragmatic account, according to which the semantic contents are simply equivalent to the natural meanings. Subsequently I will consider to what extent it may have to be reinterpreted as a diachronic account – and what difference this may make on the empirical side. Altogether, the aim of what follows is not to present a conclusive explanation for

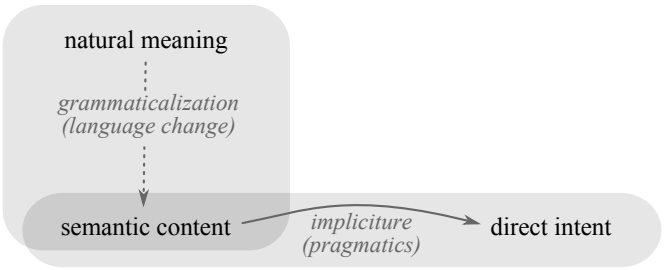


Figure 7.1

the assumed intents, but rather to show how such an explanation may be found, and to highlight which aspects of the ICM theory we may essentially get for free, given natural meaning, and which are in need of further explanation.

To clarify: to say that natural meaning may suffice is not to deny that intonation is linguistically (categorically) structured, as explained at the start of this chapter. There are two parts to Gussenhoven's proposal: (i) that intonational phonology consists of grammaticalized versions of gradient, paralinguistic phonetic features; and (ii) that intonational *meaning* is in part a grammaticalized version of the (natural) meaning of gradient, paralinguistic phonetic features. The position that I will explore maintains (i) while trying to do without (ii).

A pragmatic account

For a purely pragmatic (non-diachronic) account of the relation between natural meaning and the assumed intents, let us tentatively assume the following:

7.6. Assumption. **Contents of trailing/boundary tones (tentative):** The semantic contents of trailing tones and boundary tones are equivalent to their natural meanings according to the Production Code, i.e., that the utterance is finished (low) or unfinished (high).

With this assumption as our starting point, what we must show is that expressing (un)finishedness may serve compliance marking, i.e., that the natural meanings according to the Production Code may serve to clearly communicate the assumed intents according to ICM. (Since (un)finishedness corresponds to the meaning that many generalist accounts of intonational meaning assume to begin with, this would effectively show that the ICM theory can be pragmatically derived from these existing accounts.)

According to the maxim of Content Efficacy (chapter 4), the assumed intents according to ICM should be the first possible (i.e., potentially true and thematic) intents that come to the mind of an audience given the contents, i.e., given the natural meanings as determined by the Production Code. To that end, at least the following four conditions must be met:

(i) trailing tones and boundary tones recognizably serve the communication of an intent;

(ii) their intents according to ICM are normally worth sharing;

(iii) their purported contents, i.e., their natural meanings, are not appropriate as intents;

(iv) their intents are somewhat closely associated with their contents.

I will tentatively show why these may hold.

Condition (i) That trailing tones and boundary tones contribute intents may be a consequence of their linguistic (categorical) as opposed to paralinguistic nature, plus the fact that these intonational features are not mandatory: according to ToDI, there exist well-formed contours without trailing tones or boundary tones. For this reason the production of a trailing tone or boundary tone must serve some communicative intention, and it will be recognizable as such.

Condition (ii) That the intents according to ICM are normally worth sharing follows in the current account from the maxim of Compliance Transparency, combined with the Clarification Principle, as explained in chapter 4. Together, they ensure that for any theme $\mathcal{T}_i$ addressed, the following theme is evoked (the Reasonable Goal Principle permitting):

$$\{^\wedge\Box \textsc{Maxims}(\mathcal{T}_i), {}^\wedge\neg\Box \textsc{Maxims}(\mathcal{T}_i)\}$$

Hence the intents of boundary tones and trailing tones will be thematic. Of course this is only a proper explanation of the assumed intents to the extent that the maxim of Compliance Transparency was explained, and to the extent that we can explain why the maxims are the way they are – in chapter 4 I suggested only a partial explanation.

Condition (iii) To show that the natural meanings of low and high trailing/boundary tones are themselves inadequate as intents, we must show that literal (un)finishedness of the utterance is not normally both thematic and true. This is easy for high trailing and boundary tones at the end of the utterance: their natural meaning would in that case be false. Similarly, the natural meanings of low boundary tones and trailing tones are false when they occur within an utterance rather than at the end. The same does not hold in the opposite situation, i.e., the natural meanings of internal high tones and final low tones are true. Hence, to show that condition (iii) holds in general, we must show that even if the natural meanings of trailing and boundary tones happen to be true, they will normally be athematic, i.e., not worth sharing. I will try to make this somewhat plausible.

One possible reason why literal (un)finishedness of an utterance would normally not be worth sharing is that for the purposes of a conversation, and for smooth turn-taking, it does not really matter whether speakers get to finish their utterances in some literal sense. What matters is that they manage to clearly convey their intents, i.e., compliance with I/A-Clarity. Indeed, conversational turns often overlap, e.g., according to a corpus study by Gravano (2009) 13.1 percent of turn-takings are "non-interrupting" but still involve overlap (the "O"-label, p.28). This also suggests that it is often sufficiently obvious whether an utterance will soon be finished or not, which is another possible reason why indicating literal (un)finishedness may not normally be necessary. Of course turn-taking does strongly correlate with literal finishedness – in Gravano's study 39.9 percent are "smooth switches" (the "S"-label), which do not involve overlap and where the previous utterance is intuitively finished – but this can be a mere side effect of the fact that rational speakers will not utter much more than necessary for clearly conveying their intents (Manner-Conciseness).

In fact, the literature on turn-taking considers both rises and falls to be turn-yielding cues; the typical turn-holding cue is, rather, the absence of a boundary tone (%), i.e., a level/plateau contour (Wichmann and Caspers 2001; corroborated also in Gravano 2009, p.31). This is expected on the current account: in cases where compliance marking is mandatory, which may often be the case, the absence of a boundary tone will imply unfinishedness. Crucially, however, this unfinishedness is not predicted to necessarily be an intent – it is primarily a mere implication from the absence of compliance marking. This is what one would expect if (non-)compliance but not literal (un)finishedness is worth sharing.

Condition (iv) This condition states that the intents must be somewhat closely associated to the natural meanings, a prerequisite for impliciture. This is difficult to argue without a more precise account of associations, but intuitively this requirement seems to be met. The maxims can be conceived of as a set of relevant respects in which an utterance can be (un)finished, perhaps not literally as a sequence of sounds, but certainly in its role as an attempt to achieve certain conversational goals: suspending a maxim means that more work remains to be done. (This aligns with my earlier claim, in section 4, that the ICM theory is basically a way of making existing proposals in terms of (un)finishedness more precise). In this way, the route from unfinishedness to non-compliance is superficially similar to more ordinary cases of impliciture, e.g., from "John didn't finish the book" to, depending on John's occupation, either that he didn't finish *reading* it or that he didn't finish *writing* it. If indeed (non-)compliance is worth sharing while literal (un)finishedness is not (conditions (ii) and (iii)), it seems that an impliciture of this sort could hardly fail.

Although promising, various aspects of the assumed intents remain to be explained. I will mention two central aspects but I will leave an explanation for an-

other occasion. One aspect is the division of labor between boundary tones, which indicate (non-)compliance relative to the main theme, and trailing tones, which do so relative to a theme responsible for the accent. It is not obvious to me how this could be derived from the natural meaning of trailing tones, but, given the relation between accentuation and themes (which Gussenhoven (2002) explains in terms of a biological "Effort Code"), and given the fact that (non-)compliance must somehow be indicated relative to all themes addressed, the division of labor is certainly non-arbitrary in an intuitive sense – perhaps the maxim of Manner-Orderliness could play a role here. A second aspect in need of explanation is that trailing tones are assumed to indicate (non-)compliance of the utterance up to the next high or low boundary tone, rather than, say, up to the next accent, or up to the next boundary regardless of tone (i.e., including %). A possible and I think plausible explanation is that if it is necessary to indicate (non-)compliance relative to *some* theme at all, it will certainly be necessary to indicate (non-)compliance relative to the *main* theme – and the latter is the case only for utterance parts up to a high or low boundary tone. (Whether this explanation is on the right track or not, the empirical relevance of this aspect of the assumed intents will become clear in chapter 10 on list intonation.)

The foregoing considerations were based on the Production Code. Gussenhoven (2002) assumes that pitch is governed also by the "Frequency Code", which associates high pitch with submissiveness and uncertainty (based on Ohala 1983 and subsequent work). The Frequency Code and the Production Code are not incompatible, and may in certain cases lead to the same conclusion: if a speaker leaves her utterance unfinished (e.g., suspends a maxim) this may be because she was unsure how to finish it. However, while uncertainty can be inferred from certain maxim suspensions and vice versa, not all permissible maxim suspensions involve uncertainty, as we will see in chapter 8. For this reason it is difficult to see how the intents of the ICM theory could in general be derived from the Frequency Code alone, i.e., from uncertainty as the natural meaning of high pitch.

A more diachronic perspective

As I announced, the foregoing attempt to derive the assumed intents from the Production Code may lend itself also to a diachronic interpretation like Gussenhoven's (2002): the four conditions (i)-(iv) could in principle be mere tendencies, which would over time have given rise, through grammaticalization, to a linguistic convention that uses trailing tones and boundary tones for compliance marking (Gussenhoven does not make the purported grammaticalization process any more precise). In contexts where the four conditions (i)-(iv) hold, the pragmatic and diachronic accounts will make the same predictions, but otherwise they may differ: the more grammaticalized the semantic contents are, i.e., the closer they are to the assumed intents, the less variation one would expect in the intents conveyed by boundary tones and trailing tones.

For instance, there may turn out to be contexts in which condition (iii) does not hold, i.e., in which literal (un)finishedness *is* worth indicating. The pragmatic account may predict that in such a context boundary tones *can* be used to indicate (un)finishedness; but an account in terms of grammaticalization may predict that boundary tones will be used for compliance marking in that context like in any other. (The case is not as simple as I make it out to be, since marking a violation of I/A-Clarity effectively amounts to indicating "I have not (yet) clearly conveyed the intents", which may be indistinguishable from unfinishedness; see chapter 10.) Another example: it may turn out that trailing tones sometimes occur on accented words that are not made important by a theme (i.e., that rising/falling accents sometimes occur outside of any "focus"). If so, then the required link between accent placement and the theme relative to which compliance is indicated cannot be fully conventionalized; it must be a context-dependent pragmatic enrichment (for which Manner-Orderliness would conceivably be responsible). See Hirschberg 2002 (p.2) for similar considerations that would, if valid, favor a pragmatically mediated relation between intonation and intonational meaning.

It seems to me too early to decide on empirical grounds whether the biological codes have grammaticalized in the case of English, and if so to what extent, or whether natural meaning alone is sufficient to explain how the assumed intents can be clearly conveyed, as in the purely pragmatic account I sketched. But I have shown that the intents according to the ICM theory are at least somewhat natural, and this lends the theory some independent plausibility. It also suggests cross-linguistic applicability: assuming that the relevance of something like compliance with the maxims is not an idiosyncrasy of speakers of English but a general trait of rational conversation, we may expect some form of intonational compliance marking in other languages as well, though the details will depend on the precise intonational phonology of those languages, and perhaps on the precise nature and relative importance of the maxims (which may in principle involve some conventionalization as well).

Lastly, the aim to explain intonational meaning in terms of natural meaning is compatible with there being genuine exceptions cross-linguistically, provided these can somehow be explained (Gussenhoven, 2002). This could be done, for instance, by identifying a counterforce: Gussenhoven (2000) argues for a tonal dialect of Dutch (Roermond) that the need to preserve a certain lexical tone contrast has in that dialect blocked the use of the utterance-final high pitch for questions.

4.5 Naturalness and intonational phonology

Whether a theory of intonational meaning is natural depends also on the underlying phonological assumptions. For instance, according to the ICM theory, level boundaries do not serve to convey any (direct) intents, and this seems natural if, as in the ToDI system, level boundaries are analyzed as the absence of a boundary tone (%). In ToBI, however, boundaries necessarily have a (high or low) tone,

and a level boundary must be analyzed as a high *phrase accent* (roughly, a high trailing tone) followed by a low boundary tone, transcribed as "H-L%". Hence, against the background of ToBI the assumption in ICM that level boundaries do not convey any intent appears less natural – one would rather expect it to convey *two* intents. More generally, ToBI lacks the parallelism between high/low/absent trailing tones and high/low/absent boundary tones that ToDI offers and on which the ICM theory relies. Hence, the ICM theory is only natural to the extent that the ToDI assumptions are correct.

Conversely, existing accounts of intonational meaning may be natural within ToBI but not within ToDI. For instance, Bartels (1999) assumes that the low boundary tone L% does not carry meaning, which may be reasonable if boundary tones are mandatory as in ToBI – one of the two options could then be a meaningless default – but implausible if there is the third option of having no boundary tone at all, as in ToDI. Another example is the way in which Steedman (2014) maps the space of possible accents onto a space of possible meanings, which I already summarized earlier:

	success	failure
thematic (suppose)	L+H*	L*+H
rhematic (update)	H*, H*+L	L*, H+L*

Within ToBI this looks quite systematic and arguably natural: the distinction between the rows, i.e., thematic (supposing something to be common ground) or rhematic (updating the common ground), corresponds to a distinction between rising accents and the rest; and the distinction between the columns aligns with the location of the asterisk: on the high tone for success, on the lone tone for failure. But within ToDI this apparent naturalness disappears. For one, ToDI does not draw a distinction between L+H* and H* (top left and bottom left), a distinction which Steedman (p.4) is aware is not reliably identified by trained annotators. Moreover, ToBI's L*+H accent (top right) corresponds in ToDI to a delayed high accent (prefixing L to H*), which makes it phonologically more similar to the high accents in the bottom left cell than to the low accents in the bottom right cell. That is, what is in ToDI only a single phonological operation (which Gussenhoven (1984) conceives of as merely adding some extra emphasis) corresponds in Steedman's theory to a difference along two important semantic dimensions.

In sum, the naturalness of a theory of intonational meaning can be assessed only relative to a theory of intonational phonology. Because of this, if the ICM theory is empirically adequate this will be evidence in favor of a theory like ToDI – even though a theory that is descriptively equivalent to ICM can be obtained by assigning the assumed intents instead to the corresponding building blocks of, say, ToBI, or any theory of intonational phonology that is sufficiently fine-grained. Of course, as Ladd (2008, p.150) notes, in part in the citation given in the introduction to the current chapter, a theory of intonational meaning can only inform a theory

of intonational phonology if it makes precise and in principle falsifiable predictions. I have yet to show that the ICM theory meets this standard.

5 Conclusion and outlook

This chapter presented a theory of Intonational Compliance Marking (ICM). The core assumption is that boundary tones and trailing tones (according to ToDI) serve to indicate whether the speaker takes her utterance to comply with the maxims or not, relative to either the main theme or some theme that is to blame for the accent. I have argued that this assumption is at a very general level in line with much existing work. In order to make the predictions of the ICM theory more transparent, chapter 8 offers an overview of the range of possible *clashes* in Attentional Pragmatics, which serve to explain on which maxim suspensions a high boundary tone or trailing tone may be blamed. Subsequent chapters will rely on this to show that the ICM theory, combined with Attentional Pragmatics, generates detailed accounts of several phenomena:

- rising declaratives (or "declarative questions"; chapter 9);
- intonation on lists (chapter 10);
- rise-fall-rise intonation (chapter 11); and
- intonation on (interrogative) questions (chapter 12).

Where available I will compare the ICM theory in detail to "specialist" accounts of intonational meaning.

Recall that one reason for developing a theory of intonational meaning was that it could mend an explanatory gap in the chapters of part I: what warrants the assumption that the speaker takes her utterance to comply with the maxims? If the ICM theory is correct, the answer is that compliance is indicated standardly by intonation. This in some sense completes the account of exhaustivity presented in chapter 3. It also casts further doubt on the common assumption, which I criticized in chapter 4, that there would be something intrinsically weak or unreliable about pragmatic implications – we just have to take intonation into account (in line, for instance, with Kadmon and Roberts 1986). More generally, as subsequent chapters will show, the ICM theory provides us with a fairly direct empirical window on the maxims and on notions like intent, theme, clashes, and the distinction between rheme-pragmatics and theme-pragmatics, all of which I have thus far been regarding as primarily theory-internal (cf. chapter 2). This suggests that these technical notions and distinctions, or ones that resemble it closely, are not just useful as auxiliary notions in a theory of conversation but also significant for language users.

Chapter 8

An overview of clashes

1 Introduction

For the ICM theory to generate precise predictions, we must be able to narrow down the range of maxim suspensions that may be to blame for a particular high boundary tone or high trailing tone. To that end I assume the following:

8.1. Assumption. A rational speaker will normally violate a maxim, potentially or knowingly, only if she is unable to comply with it, as such or due to a clash with some other maxim, in the sense of Grice 1989 (ch.2).

This is intended to follow from a conception of rationality as maximizing expected compliance (chapter 1, assumption 1.1). With this in place, understanding which maxim is to blame for a high right boundary tone amounts to understanding which clashes may have occurred, and how the speaker may have decided to cope with them. With that in mind, this chapter provides an overview of the possible clashes among the maxims of Attentional Pragmatics.

Although I will occasionally include linguistic and intonational examples for the sake of illustration, the aim of this chapter is not to apply the ICM theory to any particular empirical phenomenon, but rather to solidify our understanding of Attentional Pragmatics, as a foundation for empirical applications of the ICM theory in subsequent chapters. For this reason the reader who is eager to see a concrete application of the ICM theory may wish to jump to chapter 9 (and beyond) and return to the current chapter afterwards for a deeper understanding. (Really, do feel free to jump ahead.)

It will be useful to distinguish *ontic compliance*, i.e., actual compliance with a maxim, from *epistemic compliance*, i.e., compliance according to the speaker; and analogously to distinguish *ontic clashes*, which occur if there is no intent that complies with a certain set of maxims, from *epistemic clashes*, which occur

if there is no intent that complies according to the speaker. For instance, ontic compliance with A-Quantity, of a certain intent and a certain theme, amounts to:

$$\text{A-Quantity}(\mathcal{A}, \mathcal{T})$$

and epistemic compliance to:

$$\Box\, \text{A-Quantity}(\mathcal{A}, \mathcal{T})$$

The account of exhaustivity in chapter 3 took off from the assumption of epistemic compliance with A-Quantity. As for clashes, ontic clashes are defined as follows:

8.2. Definition. **Ontic (proper) clashes**

- A set of maxims *ontically clash* relative to a theme if there is no intent that ontically complies with all of them relative to the theme.
- A set of maxims *properly ontically clash* relative to a theme if they ontically clash, but no proper subset clashes, relative to the theme.

To illustrate, A-Quality and A-Relation ontically clash relative to the theme denoted by $\mathcal{T}_i$ if:

$$\neg\exists\mathcal{A}(\text{A-Quality}(\mathcal{A}) \wedge \text{A-Relation}(\mathcal{A}, \mathcal{T}_i))$$

and they properly ontically clash if, in addition, neither of these maxims clashes on its own:

$$\exists\mathcal{A}\, \text{A-Quality}(\mathcal{A}) \wedge \exists\mathcal{A}\, \text{A-Relation}(\mathcal{A}, \mathcal{T}_i)$$

Note that according to the definition even (a set containing) a single maxim can be meaningfully said to "clash", namely if there is no way to ontically comply with it. Similarly, epistemic clashes are defined as follows:

8.3. Definition. **Epistemic (proper) clashes**

- A set of maxims *epistemically clashes* relative to a theme if there is no intent that epistemically complies with all of those maxims relative to the theme.
- A set of maxims *properly epistemically clashes* relative to a theme if they epistemically clash, but no proper subset epistemically clashes, relative to the theme.

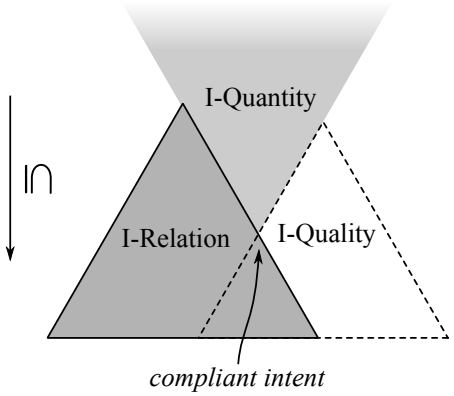


Figure 8.1

For instance, A-Quality and A-Relation epistemically clash relative to the theme(s) denoted by $\mathcal{T}_i$ if:

$$\neg\exists\mathcal{A}(\Box\,\text{A-}\textsc{Quality}(\mathcal{A}) \wedge \Box\,\text{A-}\textsc{Relation}(\mathcal{A}, \mathcal{T}_i))$$

and they properly epistemically clash if in addition:

$$\exists\mathcal{A}\Box\,\text{A-}\textsc{Quality}(\mathcal{A}) \wedge \exists\mathcal{A}\Box\,\text{A-}\textsc{Relation}(\mathcal{A}, \mathcal{T}_i)$$

It is primarily the epistemic kind of clash that matters for explaining and predicting speaker behavior, e.g., the use of certain intonation contours. But we cannot understand the range of epistemic clashes without first considering the range of ontic clashes: after all, if there is an ontic clash in any of the speaker's belief worlds, then there is also an epistemic clash – although the converse does not generally hold, as we will see. For this reason I will give an overview of both types of clashes: section 2 of ontic clashes and section 3 of epistemic clashes. These sections concentrate on clashes involving the I-maxims; although clashes among the A-maxims will also be listed, an explanation of those clashes will be left to appendix D. Section 4 concludes.

2 Overview of ontic clashes

2.1 Clashes among I-Quality, I-Relation and I-Quantity

For clarity I will use Venn diagrams of the space of all possible informational intents, i.e., propositions. A first example is figure 8.1. The diagram is organized with weaker propositions (larger sets of worlds) at the bottom and stronger propositions at the top, all the way up to a contradiction. The regions indicate which propositions would, as intents, comply with the various maxims. The propositions within the dashed triangle are taken to be true by the speaker, i.e.,

they comply (ontically and epistemically) with I-Quality. By virtue of the K-axiom for beliefs this set is *closed under intersection*, a property that is signified by the upright triangular shape, with stronger propositions at the top in line with the vertical organization of the diagram.

The gray, upright triangle with the solid border contains all and only propositions that would, as intents, comply with I-Relation relative to a given theme; indeed, it can be conceived of as the theme itself. In this particular example, the theme forms a triangle, i.e., it is closed under intersection, like most themes that I have been assuming throughout this dissertation – although this need not always be the case, as we will see.

The gray, inverted triangle contains all and only propositions that, relative to the given theme, comply with I-Quantity. This region extends upwards indefinitely, because if a proposition meets the demands set by I-Quantity, then so will any stronger proposition. It extends upwards from the weakest proposition that is at least as strong as all thematic propositions taken to be true. In case the region for I-Relation is closed under intersection, i.e., triangular, then so is the overlap of the regions for I-Relation and I-Quality. The inverted triangle for I-Quantity then extends upwards from the top of this overlap.

If there is an intent that ontically complies with the I-maxims, then we can find it by intersecting the three maxim-regions. In figure 8.1 the three regions intersect in a single point. This is in line with fact 2.17 given already in chapter 2, which stated that if there is an (ontically) compliant intent at all, there is a unique one. Moreover, we can investigate whether and how a certain subset of the maxims can be jointly complied with by intersecting just the relevant regions. For instance, the line segment at the border of the regions for I-Quantity and I-Quality contains precisely those intents that comply with both.

No individual clashes

Each of the I-maxims individually (except I-Clarity, discussed further below) can always be ontically complied with: I-Quality by whichever intent is true, for instance a tautology; I-Relation by whichever intent is thematic, since themes cannot be empty; and I-Quantity by whichever intent is at least as strong as all thematic propositions that the speaker takes to be true, for instance a contradiction.

8.4. Fact. None of the I-maxims except I-Clarity individually ontically clashes.

Formally, this means that, for all normal pragmatic models $\mathbf{M}$, for any constant $\mathcal{T}_i$ denoting a theme in every world (i.e., a non-empty set; chapter 2, assumption 2.2):

$$\mathbf{M} \models \exists p\, \text{I-Quality}(p)$$
$$\mathbf{M} \models \exists p\, \text{I-Relation}(p, \mathcal{T}_i)$$
$$\mathbf{M} \models \exists p\, \text{I-Quantity}(p, \mathcal{T}_i)$$

No I-Quality/I-Quantity clash

I-Quality and I-Quantity together can always be complied with, namely by any intent at least as strong as the strongest thematic proposition(s) that are believed to be true.

8.5. Fact. I-Quality and I-Quantity do not ontically clash.

Formally, this means that for any normal pragmatic model $\mathbf{M}$, for any constant $\mathcal{T}_i$ denoting a non-empty set in every world:

$$\mathbf{M} \models \exists p(\text{I-Quality}(p) \wedge \text{I-Quantity}(p, \mathcal{T}_i))$$

I-Relation/I-Quality clash

It is possible for a theme to be such that nothing is both thematic and taken to be true. A theme of this type is presumably addressed by the following question:

(1) A: Is the moon made of cheese, sugar, or both? (L%)

Figure 8.2 depicts such a situation. The fact that I-Quality and I-Relation ontically clash is visible from the fact that the regions for I-Relation and I-Quality do not overlap. Note that I-Quantity is vacuously complied with: since nothing is both

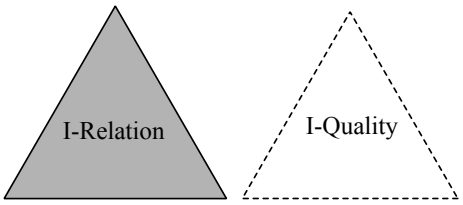


Figure 8.2

thematic and taken to be true, nothing needs to be asserted. For this reason I have omitted the region for I-Quantity from the figure – it would have covered the entire space.

In sum, the following holds:

8.6. Fact. I-Quality and I-Relation may ontically properly clash.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ such that, in some world w, for some constant $\mathcal{T}_i$ denoting a non-empty set:

$$\mathbf{M}, w \models \begin{pmatrix} \exists p\, \text{I-Quality}(p) \wedge \\ \exists p\, \text{I-Relation}(p, \mathcal{T}_i) \wedge \\ \neg\exists p \begin{pmatrix} \text{I-Quality}(p) \wedge \\ \text{I-Relation}(p, \mathcal{T}_i) \end{pmatrix} \end{pmatrix}$$

I-Relation/I-Quantity clash

I-Relation and I-Quantity may ontically clash. For instance, in figure 8.3a I-Quantity requires that two propositions be confirmed whose intersection is not thematic (nor is anything stronger thematic). This clash is in some sense to blame on the fact that the theme is not closed under intersection. But as figure 8.3b illustrates, the lack of closure under intersection does not always cause clashes: to prevent a clash it suffices if the set of what is both thematic and taken to be true is closed under intersection, i.e., if the overlap between the regions for I-Relation and I-Quality is triangular. Note that this is always the case if the theme itself is already closed under intersection, as in figure 8.1 given earlier (one way to see this: the intersection of two meet-semilattices is again a meet-semilattice).

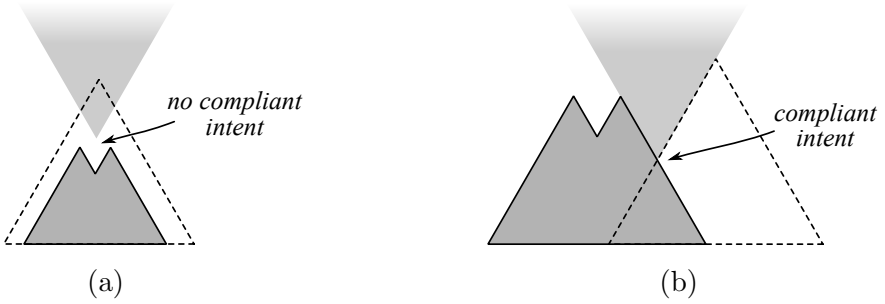


Figure 8.3

As I explained in chapter 2, contrary to what is sometimes assumed in the literature, closure under intersection is not in general an appropriate property to assume for themes, at least in the current approach. I assumed something slightly weaker, namely the Reasonable Closure Principle: themes are closed under intersection as far as the Reasonable Goal Principle permits, i.e., as far as these intersections can potentially be established. This implies that situations like figure 8.3b are perfectly ordinary, while situations like figure 8.3a must involve a misalignment of beliefs: an ontic I-Relation/I-Quantity clash may occur only if the theme was introduced by someone who considered the intersection to be impossible to establish while the current speaker takes it to be true. Thus:

8.7. Fact. I-Relation and I-Quantity may ontically properly clash, but only if the beliefs of the person who introduced the theme and the current speaker do not align.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ such that, in some world w, for some constant $\mathcal{T}_i$:

$$\mathbf{M}, w \models \begin{pmatrix} \exists p\, \text{I-Quantity}(p, \mathcal{T}_i) \wedge \\ \exists p\, \text{I-Relation}(p, \mathcal{T}_i) \wedge \\ \neg\exists p \begin{pmatrix} \text{I-Quantity}(p, \mathcal{T}_i) \wedge \\ \text{I-Relation}(p, \mathcal{T}_i) \end{pmatrix} \end{pmatrix}$$

The following example, which will be discussed in more detail in chapter 12, arguably involves this type of clash:

(2) A: Was John at the party, or Mary?
L*H H% H*L L%
B: Actually, both. (L%)

Whether there is indeed an I-Relation/I-Quantity clash for B depends on the precise predictions of the ICM theory with regard to question intonation, which I will for now leave implicit. Assuming that there is such a clash, it appears (from the low boundary tone on B's response) that B decided to cope with it by simply adding the intersection to the prior theme, a slight thematic discontinuity that a future, more detailed theme-pragmatics will have to account for.

I-Relation/I-Quality/I-Quantity clash

A three-way clash may also occur, necessarily if there is a two-way clash, but also properly, i.e., without there being any two-way clash. This is illustrated in figure 8.4, where labeled arrows indicate the locations of some propositions that ontically comply with (a) I-Relation and I-Quantity, (b) I-Quality and I-Quantity, and (c) I-Relation and I-Quality – yet there is no intent that complies with all three. Like a two-way I-Relation/I-Quantity clash, a proper three-way clash is

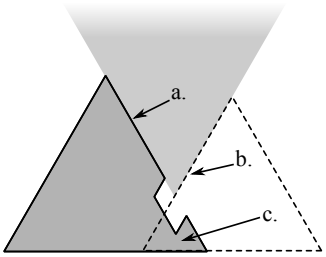


Figure 8.4

typically ruled out by the Reasonable Closure Principle: closure under intersection mends the kind of gap that must exist in the theme for a proper three-way clash to occur. In sum:

8.8. Fact. I-Relation, I-Quality and I-Quantity may in principle ontically properly clash, but only if the beliefs of the person who introduced the theme and the current speaker do not align.

I will omit a formalization this time.

2.2 Other ontic clashes involving the I-maxims

Clashes involving I-Clarity (and Content Efficacy)

Recall that I-Clarity demands that every intent must be commonly understood to be an intent. The ways in which I-Clarity may be achieved were only partially formalized (e.g., Content Efficacy, chapter 4), so we cannot formally prove with which maxims I-Clarity may clash. Instead, I will just assume particular clashes:

8.9. Assumption.

a. I-Clarity (and Content Efficacy) may clash on its own and with any (set of) I-maxims, but only in certain special circumstances (e.g., non-fluent speaker, background noise); and

b. I-Clarity (and Content Efficacy) may *temporarily* clash on its own, if the speaker cannot comply with it right away, in some sense.

The latter employs the term "clash" a bit more liberally than what was established at the start of this chapter, namely by adding a temporal dimension. I will briefly explain each case.

Case a. I-Clarity with any I-maxim(s) When there is loud background noise, or when the speaker or addressee is not fluent in the given language, it may happen that nothing that is thematic can be clearly expressed (an I-Relation/I-Clarity clash), or that not everything that is taken to be true and thematic can be clearly expressed (an I-Quantity/I-Clarity clash), that nothing can be communicated at all (an I-Clarity clash), and so on. In such circumstances, there may often be a parallel clash involving Content Efficacy: a non-fluent speaker may be unable to express with certainty a content suitable for conveying an intent that complies with the I-maxims. (Recall from chapter 2 that the contents of an utterance are determined not by the speaker's intentions, but by the conventions of the language plus what is uttered.) To illustrate, consider (15) from chapter 7, repeated here:

(3) *(English tourist in a French café.)*
A: I'd like... err... je veux... a black coffee?
H* H%

The tourist lacks a French expression for "a black coffee", and may doubt that the waiter understands the English expression. As a consequence, the tourist is unable to clearly communicate anything true and thematic (the theme being, say, what A wants to drink), i.e., there is an I-Clarity/I-Relation/I-Quality clash. Furthermore, this is a *proper* clash if we assume that there are some athematic or false things that A can clearly express (e.g., "je t'aime").

Case b. Temporary clash In the course of an utterance a speaker may sometimes be unable to comply with I-Clarity right away. This is arguably the case in the following example:

(4) John was there, Mary was there, and Bill was there.
L*H H% L*H H% H*L L%

For some reason that need not concern us here (say, the length of the utterance), the speaker found it necessary to intonationally indicate non-compliance at two prefinal intonation phrase boundaries. Because ultimately the utterance does comply with the maxims relative to the main theme, as indicated by the final low boundary tone, the prefinal high boundary tones can only be blamed on I-Clarity: the (otherwise compliant) intent has not yet been clearly conveyed. This prediction will be stated more formally and in more generality in chapter 10 on list intonation, where examples like (4) will be covered in detail. What matters for now is that the I-Clarity violations in (4) are only temporary, and must therefore be explained in terms of a temporary clash: the speaker is unable to comply with I-Clarity right away. Note that in each case Content Efficacy is also temporarily violated, e.g., the content of just the first list item seems to convey an intent to the effect that John was at the party, but this is not an actual intent of the utterance (for it would not have complied with I-Quantity).

No clashes involving Conciseness, Prominence Alignment, Compliance Transparency

I assume that the Conciseness, Prominence Alignment and Compliance Transparency submaxims of Manner, unlike Content Efficacy, do not clash with the I-maxims:

8.10. Assumption. Conciseness, Prominence Alignment and Compliance Transparency do not clash with any of the I-maxims.

This is intended to follow from their definition as ceteris paribus conditions (following Carston 2005 as far as conciseness goes): speakers maximize conciseness and prominence alignment only as far as maximizing expected compliance with the other maxims allows. (Recall that the weak status of Conciseness contrasts with approaches to the symmetry problem criticized in chapter 5.) It is worth

noting, as I did in chapter 4, that Prominence Alignment may occasionally appear to clash with a maxim of Politeness (e.g. the Irony Principle of Leech 1983, p.82), and that a future version of the current theory may take this into account. It is too early to say, however, whether the appearance of such clashes will be best analyzed in terms of a genuine rheme-pragmatic clash, or an incorporated clash like between I-Quality and I-Quantity, or perhaps a theme-pragmatic maneuver. For now this can be set aside.

Clashes between the I-maxims and A-maxims

(Clashes among the A-maxims themselves, regardless of the I-maxims, will be discussed separately in appendix D.) Proper clashes between the A-maxims and the I-maxims may occur only due to I/A-Clarity, i.e., if a certain combination of informational intent and attentional intent is impossible to clearly convey, whereas conveying each intent individually would be unproblematic:

8.11. Fact. There is no proper clash between any set of I-maxims and any set of A-maxims, except maybe (but maybe not) clashes involving I/A-Clarity.

However, as the formulation of this fact suggests I have been unable to conceive of a situation with such a clash, i.e., a situation in which a compliant informational intent can be clearly conveyed, and a compliant attentional intent as well, but not both by the same utterance, a matter for which inherent limitations of the speech channel or the linguistic conventions would be to blame. The possibility of this type of clash (a kind of limit to linguistic expressivity) cannot be ruled out until Content Efficacy is formalized and the types of considerations in chapter 6 are further developed, which must wait for another occasion.

The complete absence of other types of clashes between the I-maxims and the A-maxims may come as a surprise. After all, in chapter 6 I explained that not every combination of informational intent and attentional intent can be rational, e.g., relative to certain types of themes the informational intent must always be the union of the attentional intent. However, this apparent dependence between informational and attentional intents is not a genuine dependence; it is a mere consequence of their co-dependence on something else: the A-maxims and the I-maxims constrain their respective intents in terms of the same theme and the same epistemic state. From the perspective of the speaker, the I-maxims do not constrain the attentional intent, nor do the A-maxims constrain the informational intent.

2.3 Summary

To sum up, the range of proper, ontic clashes involving the I-maxims is as follows:

1. I-Relation and I-Quality, if nothing thematic is taken to be true;

2. I-Relation(, I-Quality) and I-Quantity, if I-Quantity is more demanding than I-Relation (and I-Quality) permits – only in case of disagreement, given the Reasonable Closure Principle;

3. I-Clarity (and Content Efficacy) with basically any I-maxim(s), in situations that compromise clear communication – and maybe with the A-maxims; and

4. I-Clarity (and Content Efficacy) on its own, though only temporarily, within longer utterances.

Each of these ontic clashes will, if it occurs in a belief world, give rise to a corresponding epistemic clash. However, when discussing the range of epistemic clashes in what follows I will ignore cases 3. and 4., because covering these again at the epistemic level will not add much to the foregoing discussion, given the lack of formalization.

Appendix D gives a similar overview of clashes involving the A-maxims. In a nutshell, the ontic clashes involving the A-maxims are:

5. A-Relation and A-Quality, if nothing thematic is taken to be possible;

6. A-Relation(, A-Quality) and A-Parsimony – only if the theme is not *chain-complete* (cf. chapter 3);

7. A-Clarity (and Content Efficacy) on its own and with various maxims, analogously to I-Clarity, i.e., 3. and 4. above.

3 Overview of epistemic clashes

3.1 No clash of I-Quality and I-Quantity individually or together

I-Quality on its own does not epistemically clash. Given the introspection axioms for belief (or taking oneself to know), if a speaker believes that her intent is true, she knows that she does. As such, ontic compliance and epistemic compliance coincide for I-Quality. Hence, since I-Quality does not ontically clash, it does not epistemically clash either: any proposition that the speaker takes to be true suffices, e.g., a tautology.

Neither does I-Quantity epistemically clash. However, ontic and epistemic compliance with I-Quantity do not coincide: for epistemic compliance with I-Quantity, we need a proposition that is sufficiently strong for I-Quantity to be satisfied in every belief world. Across the speaker's belief worlds, the speaker's beliefs remain the same, but the theme may vary (if thematic competence does not hold). Hence, for I-Quantity to be satisfied in every belief world, the intent must be at least as strong as every *potentially* thematic proposition that the speaker takes to

be true. This means that epistemic compliance with I-Quantity is potentially more demanding than ontic compliance with I-Quantity (and they are simply different if the speaker is entirely misinformed about the theme, which is possible for themes such as *the theme behind the previous utterance*). Nevertheless, I-Quantity on its own can always be epistemically complied with, e.g., a contradiction would do.

Neither do I-Quality and I-Quantity together epistemically clash. Given the way I-Quantity is defined, in none of the speaker's belief worlds will I-Quantity ever require more than what ontic compliance and hence epistemic compliance with I-Quality permits. For instance, the conjunction of everything a speaker takes to be true will always epistemically comply with both I-Quality and I-Quantity. Hence, we have:

8.12. Fact. I-Quality and I-Quantity do not epistemically clash individually, nor with each other.

Formally, this means that for all normal pragmatic models $\mathbf{M}$, for any constant $\mathcal{T}_i$ denoting a non-empty set in every world:

$$\mathbf{M} \models \exists p \Box \text{ I-Quality}(p),$$
$$\mathbf{M} \models \exists p \Box \text{ I-Quantity}(p, \mathcal{T}_i), \text{ and even}$$
$$\mathbf{M} \models \exists p \Box (\text{I-Quality}(p) \wedge \text{I-Quantity}(p, \mathcal{T}_i))$$

This means that, if we continue to set aside I-Clarity for the moment, all epistemic clashes of the I-maxims will have to involve I-Relation.

3.2 I-Relation clash

As long as the speaker knows what the theme is, I-Relation cannot epistemically clash – after all, it does not ontically clash, since themes cannot be empty. But if the speaker is uncertain about the theme there may not be any proposition that the speaker takes to be thematic, i.e., that is thematic in each of the speaker's belief worlds.

8.13. Fact. I-Relation may epistemically clash, but only if thematic competence does not hold.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ such that, in some world w, for some constant $\mathcal{T}_i$ denoting a non-empty set in every world:

$$\mathbf{M}, w \models \neg\exists p \Box \text{ I-Relation}(p, \mathcal{T}_i)$$

But for this to obtain $\mathbf{M}$ must not validate thematic competence.

This type of clash plausibly occurs in the following example (adopted from Ward and Hirschberg 1985):

(5) A: Are you a doctor?
B: I have a PhD...
L*HL H%

Ward and Hirschberg take the rise-fall-rise intonation on B's answer to indicate "uncertain relevance": speaker B is unsure whether A's question pertains to the medical profession or the academic degree, two themes that I will assume are mutually exclusive. In chapter 11 I will discuss this type of example in more detail, and the rise-fall-rise contour more generally.

The situation in (5) is schematically depicted by the Venn diagram in figure 8.5. It depicts the two themes that the speaker considers possible (the upright, gray

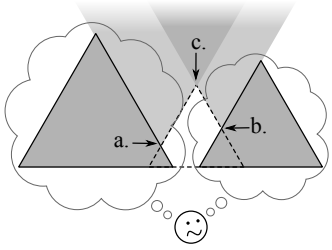


Figure 8.5

triangles as before), with corresponding upside-down triangles for I-Quantity, i.e., what I-Quantity requires depends on what the theme is. The arrows a.-c. indicate ways in which a speaker may cope with this clash, to be explained shortly. If the two regions for I-Relation had overlapped, then this overlap would have contained propositions that the speaker would have taken to be thematic, i.e., I-Relation would not have epistemically clashed. Note that the two regions for I-Quantity do overlap, i.e., I-Quantity does not epistemically clash on its own – it is, however, more demanding than it would have been for each possible theme separately, to be on the safe side.

Some possible ways of coping

There are various ways in which B may cope with the given clash. In the diagram in figure 8.5, label a. indicates where B's response in (5) could reside, repeated here in (6a); labels b. and c. indicate the locations of the two other responses (6b,c):

(6) a. B: I have a PhD...
b. B: I'm a medical doctor...
c. B: I have a PhD and I'm a medical doctor.

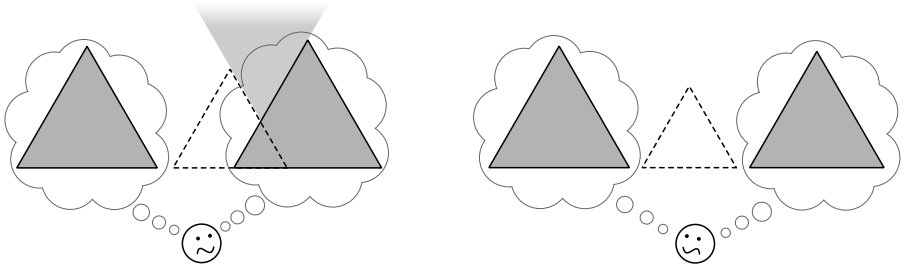
Responses (6a) and (6b) do not epistemically comply with I-Relation, although they may ontically comply with it – the speaker does not know. Moreover, they

also do not epistemically comply with I-Quantity, i.e., there is a possibility that these responses are not sufficiently informative. In contrast, (6c) does epistemically comply with I-Quantity, but it also violates I-Relation with certainty relative to either of the themes she considers possible. Perhaps (6c) can be understood as involving a thematic discontinuity, with the speaker addressing a new theme that is the closure under intersection of the union of both possible themes; alternatively, it could perhaps be treated as addressing both possible instantiations of the theme separately, with two separate intents. Different analyses will yield different predictions with regard to the range of possible intonation contours on (6c), but for current purposes it is unnecessary to explore this further.

Which of the candidate responses in (6) speaker B may choose will depend on various factors, perhaps primarily on the nature and degree of her uncertainty. For instance, if B considers it most likely that A's question is about academic degrees she may opt for response (6a); if she considers the medical perspective more likely she may prefer response (6b). If both themes are about equally likely, B could plausibly opt for (6c), which however she may avoid for reasons of modesty. Alternatively, she may not even care about the nature of A's goal and simply say "yes", which is true regardless of what A will take it to mean – though in this case arguably intent introspection would not hold, classifying it as an "abnormal" scenario (in a technical sense). Lastly, if B does care about the nature of A's goal, she may also decide to ask for clarification instead:

(7) Do you mean PhD or MD?

Response (7) would be addressing a theme evoked by the Clarification Principle. For now, the details of how speakers may decide how best to cope with a given clash do not really matter; the current aim is merely to give an overview of the range of clashes, and an impression of the range of coping strategies that are in principle available.



(a) (b)

Figure 8.6

Lastly, note that the situation in figure 8.5 is not hopeless, despite the clash, because B knows an answer to both possible themes. In contrast, in figure 8.6a she can answer only, say, the career theme, and in figure 8.6b she cannot answer

either of the two possible themes. Presumably, B's decision to address a certain theme will depend on her ability to compliantly do so. In figure 8.6b, none of the responses given above seems adequate; one would rather expect "I don't know (regardless of what sort of doctor you are after)".

3.3 I-Relation/I-Quality clash

We have already seen that I-Relation and I-Quality may ontically clash, namely if nothing thematic is taken to be true. If this is the case in any of the speaker's belief worlds, then I-Relation and I-Quality also clash epistemically. But I-Relation and I-Quality may also epistemically properly clash without there being an ontic clash in any belief world. That is:

8.14. Fact. I-Relation and I-Quality may epistemically properly clash; either due to an ontic clash in some of the speaker's belief worlds, or due to uncertainty about the theme.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ such that, in some world w, for some theme constant $\mathcal{T}_i$:

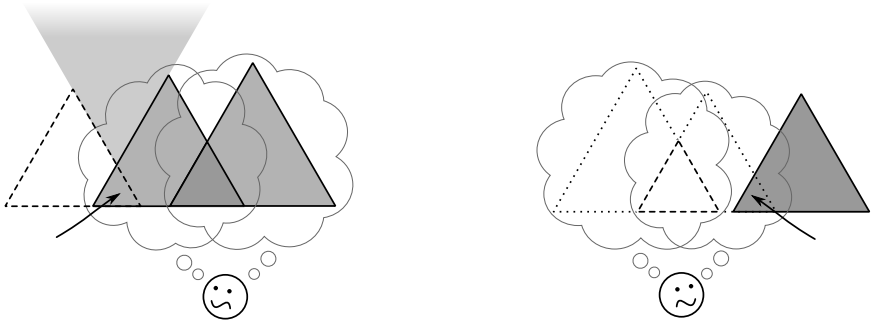
$$\mathbf{M}, w \models \left(\begin{array}{c} \exists p \Box \text{ I-Relation}(p, \mathcal{T}_i) \wedge \exists p \Box \text{ I-Quality}(p) \wedge \\ \neg \exists p \Box (\text{I-Relation}(p, \mathcal{T}_i) \wedge \text{I-Quality}(p)) \end{array} \right)$$

It will be useful to distinguish the following three types of epistemic, proper I-Relation/I-Quality clashes, for instance because each type will typically be coped with in a different way (see below):

- **Hopeless**: the speaker is certain that nothing thematic is true (an ontic I-Relation/I-Quality clash in every belief world);
- Not hopeless:
  - **Theme-uncertain**: there is a proposition that, according to the speaker, is potentially both true and thematic, but not thematic with certainty;
  - **Truth-uncertain**: there is a proposition that, according to the speaker, is potentially both true and thematic, but not true with certainty;

Put more simply but less precisely: a *truth-uncertain* I-Relation/I-Quality clash occurs due to uncertainty about which thematic propositions are true, and a *theme-uncertain* clash due to uncertainty about which true propositions are thematic. An I-Relation/I-Quality clash can be both truth-uncertain and theme-uncertain, whereas the hopeless type excludes the other two types. An I-Relation/I-Quality

clash of the theme-uncertain type is depicted in figure 8.7a, and of the truth-uncertain type in figure 8.7b. I will not separately depict an epistemic I-Relation/I-Quality clash of the hopeless type: in every belief world it will simply look like the ontic clash of figure 8.2; the precise regions may vary, as long as they do not overlap anywhere. But I will briefly clarify the diagrams in figure 8.7.



(a) (b)

Figure 8.7

Consider first figure 8.7a. That there is an epistemic I-Relation/I-Quality clash is apparent from the fact that the regions for epistemic compliance with I-Relation and I-Quality do not overlap. The clash is of the theme-uncertain type, because there is a proposition that the speaker believes is true (hence possible) that is merely potentially thematic. The arrow indicates such a proposition. Moreover, if we assume that the speaker is not uncertain in any way that is not depicted, then it is a *purely* theme-uncertain clash, i.e., one that is not also truth-uncertain: no proposition is potentially thematic and merely potentially true. (Theme-uncertain I-Relation/I-Quality clashes are always accompanied by an I-Relation/I-*Quantity* clash, as can be seen in the diagram, but not necessarily vice versa; this type of clash will be discussed further below.)

Figure 8.7b involves a new type of region: each dotted outline contains what is true in one of the speaker's belief worlds, i.e., a set of things that the speaker considers jointly possible; the intersection of these two regions is what the speaker takes to be true with certainty. That there is an epistemic I-Relation/I-Quality clash is apparent from the fact that the regions for epistemic compliance with I-Relation and I-Quality do not overlap. The clash is of the truth-uncertain type, because there is a proposition that the speaker believes is thematic (hence possibly thematic) that is merely potentially true. The arrow indicates such a proposition. Moreover, if we assume that the speaker is not uncertain in any way that is not depicted, then it is a *purely* truth-uncertain clash, i.e., one that is not also theme-uncertain: no proposition is potentially true and merely potentially thematic.

Some possible ways of coping

Hopeless I-Relation/I-Quality clash In case of a hopeless clash, a rational speaker will not even try to convey a true, thematic proposition – after all, she believes that there are none. Instead she will address a different theme, plausibly the theme evoked by the Pruning Principle, which contains the negations of the propositions of the prior theme. This situation may obtain, for instance, in the case of negative responses to what are arguably positive questions:

(8) a. A: Was John at the party? (L%)
B: No.
b. A: Who was at the party?
B: No-one.

Whether these examples really involve a clash and the Pruning Principle depends on the precise account of questions. In chapter 12 I will show that this is predicted at least for questions like (8a).

Theme-uncertain I-Relation/I-Quality clash A purely theme-uncertain clash is similar to the situation in which I-Relation epistemically clashes on its own, as in (5) above, but with the change that the possible themes do overlap – it just so happens that their overlap contains only propositions believed to be false. A theme-uncertain I-Relation/I-Quality may also be coped with in similar ways, e.g., by addressing some (combination of) possible instantiation(s) of the theme, thereby suspending I-Relation, or by asking for clarification. A clash of this type arguably occurs in the following example, which we saw already in chapter 7 (adopted from Malamud and Stephenson 2015):

(9) *(A isn't sure if B wants to know about neighborliness or suitability for dating.)*
B: What do you think of your new neighbor?
A: He's attractive?
H* H%

I assume that the properties that make a person neighborly and those that make a person suitable for dating overlap. If so, then so do the two possible themes that might underly B's question, which means that there cannot be a pure I-Relation clash in (9). A theme-uncertain I-Relation/I-Quality clash is more plausible: the neighbor does not possess any of the properties that are relevant to both themes (or at least none that A can immediately think of, which may be a plausible implicit domain restriction on B's question).

Truth-uncertain I-Relation/I-Quality clash One possible way of coping with a truth-uncertain clash is to simply assert a thematic proposition, hoping

that it will be true. This could plausibly be the situation in which rising declaratives like (12) in chapter 7 would be uttered, repeated here:

(10) *(B sees A enter the room with an umbrella.)*
B: It's raining?
H* H%

Indeed, in chapter 9 I work out the details of an account of examples like (10) in terms of an I-Quality suspension that is due to a truth-uncertain I-Relation/I-Quality clash. As I proposed in chapter 2, suspending I-Quality is rational only if the truth of the intent is deemed sufficiently probable to outweigh the risk of violating such an important maxim. If this is not the case, the preferred way of coping with this type of clash is to violate I-Relation instead, by saying something that is true but certainly athematic. In chapter 11 I will argue that the latter is the case in some of the "uncertain relevance" uses of rise-fall-rise intonation, e.g., (11):

(11) A: Have you ever been West of the Mississippi?
B: I've been to Missouri...
L*HL H%

Of course not just *any* true, athematic proposition will be an appropriate informational intent. In chapter 11 I will propose an account of examples like (11) in terms of the Strategy Principle, according to which a side theme is addressed as part of a strategy for the main theme.

3.4 I-Relation/I-Quantity clash

I-Relation and I-Quantity may epistemically properly clash, either due to an ontic clash in some belief world (the type of clash that, recall, would involve misaligned expectations, due to the Reasonable Closure Principle), or due to uncertainty about the theme. I will here ignore the former, because discussing it again would not add anything; but I will briefly explain the latter. An epistemic I-Relation/I-Quantity clash without a corresponding ontic clash may occur if the speaker takes some proposition to be true and merely potentially thematic (as in the theme-uncertain I-Relation/I-Quality clash). Epistemic compliance with I-Quantity then demands that this proposition is asserted, but since it may also be athematic this prevents epistemic compliance with I-Relation. Hence:

8.15. Fact. I-Relation and I-Quantity may epistemically properly clash, even without a corresponding ontic clash, though only if thematic competence does not hold.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ such that, in some world w, for some theme constant $\mathcal{T}_i$:

$$\mathbf{M}, w \models \left(\begin{array}{c} \exists p \Box \text{ I-Relation}(p, \mathcal{T}_i) \wedge \exists p \Box \text{ I-Quantity}(p, \mathcal{T}_i) \wedge \\ \neg \exists p \Box (\text{I-Relation}(p, \mathcal{T}_i) \wedge \text{I-Quantity}(p, \mathcal{T}_i)) \end{array} \right)$$

An epistemic I-Relation/I-Quantity clash without a corresponding ontic clash is depicted in figure 8.8. In the diagram, the speaker considers two themes possible, i.e., the upright, gray triangles as before. Because one theme is contained in the other, the region for epistemic compliance with I-Relation, i.e., the intersection of the two themes, is equivalent to the smallest theme. The epistemic I-Relation/I-Quantity clash is apparent from the fact that this region does not overlap with the intersection of the two I-Quantity regions.

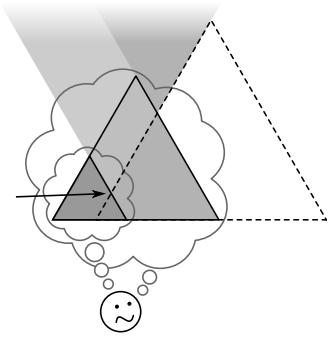


Figure 8.8

To illustrate, consider yet another example that we already encountered in chapter 7 (there (14)):

(12) M.L.: *(to a receptionist)* Hello, my name is Mark Liberman.
H* H%

What sort of analysis is the most plausible may depend on the type of venue, but let us assume, for the sake of illustration, that it is the type of receptionist where one's name is certainly thematic. This entails that there is no epistemic I-Relation clash in (12), nor an I-Relation/I-Quality clash, since one knows one's own name. What the speaker in (12) is uncertain about is merely whether his name is also *sufficient* for the receptionist to be able to assist – and this is an epistemic I-Relation/I-Quantity clash. In figure 8.8, the small theme may be "what is your name" and the larger theme "what is your name and what is the reason for your visit". The speaker in (12) has chosen to address the smaller theme first (his intent is indicated by the arrow). Whether this is an acceptable approach in a given context may depend on which of the two possible themes is the most likely, but also on considerations of politeness.

3.5 I-Relation/I-Quality/I-Quantity clash

In principle a proper three-way epistemic clash may also occur, even when there cannot be a corresponding ontic clash anywhere:

8.16. Fact. I-Relation, I-Quality and I-Quantity together may in principle properly epistemically clash; though typically only (if at all) if thematic competence does not hold.

I will omit a formal translation of this result. Although this type of clash is logically possible, I have been unable to construct a natural example. For instance, if the theme is who is at the party, a three-way clash would occur if one is uncertain not about John's presence and Mary's presence individually, nor about John, Mary and Bill's joint presence, but only about John and Mary's joint presence. More generally, just like a proper three-way *ontic* clash can occur only if the theme has some sort of gap in the middle, as depicted earlier in figure 8.4, an epistemic clash (without such an ontic clash) can occur only if a speaker's uncertainty pertains to propositions that would in some sense be in the middle of the theme. I have been unable to think of a convincing and reasonably natural example in which this would be the case.

3.6 Summary

This concludes the overview of epistemic clashes involving the I-maxims. In a nutshell, if we assume that themes are closed under intersection to the relevant extent (assumption 2.20), the range of possible epistemic clashes is the following:

1. I-Relation: if nothing is believed with certainty to be thematic;

2. I-Relation and I-Quality: if the speaker is certain that nothing thematic is true (hopeless), is unsure which true propositions are thematic (theme-uncertain), or is unsure which thematic propositions are true (truth-uncertain);

3. I-Relation and I-Quantity: in case of a corresponding ontic clash or if the speaker is unsure how much of her information is required;

And if we take the non-formalized clashes into account from the overview of ontic clashes, we must add:

4. Any I-maxim(s) with I-Clarity (and Content Efficacy): if clear communication is compromised, for instance by background noise or language problems.

5. I-Clarity on its own, though only temporarily, within longer utterances.

Omitted from this list are the three-way clash just discussed, which although logically possible may not ever occur in practice, as well as clashes between the I-maxims and the A-maxims, the possible occurrence of which has not at this point been proven (as discussed with regard to the ontic clashes).

Appendix D gives a similar overview of clashes involving the A-maxims. In a nutshell, the epistemic clashes involving the A-maxims basically parallel those of the I-maxims:

6. A-Relation: if nothing is believed with certainty to be thematic (exactly like 1. above);

7. A-Relation and A-Quality: if the speaker is certain that nothing thematic is true (hopeless), or is unsure which possible states of affairs are thematic (theme-uncertain).

8. A-Relation and A-Quantity (with optionally A-Parsimony and/or A-Quality): if the speaker is unsure how many independently possible states of affairs are thematic;

9. A-Clarity with various maxims, analogously to I-Clarity, i.e., 4. and 5. above.

4 Final remarks

If indeed maxims are only suspended in case of a clash (assumption 8.1), then the above range of epistemic clashes helps make the predictions of the ICM theory more precise:

8.17. Prediction. As far as the maxims of Attentional Pragmatics go, high right boundary tones and trailing tones may be used only if one of the possible epistemic clashes occurs, in which case in principle either of the clashing maxims may be suspended or knowingly violated (depending on probabilities, relative importance of the maxims, and details of the optimization procedure, a.o.).

An account within the ICM theory of any particular phenomenon will be constrained by this prediction, as subsequent chapters will illustrate.

The converse of prediction 8.17 may to some extent be true as well (as an empirical generalization; it is not necessarily predicted). For most of the possible clashes I was able to present plausible linguistic examples with a high boundary tone. But the presented analyses of these various examples remained intentionally sketchy. Determining with certainty which maxim suspensions and clashes are to blame for a given high boundary tone or trailing tone is not necessarily always

easy or even possible. But some of the examples considered in this chapter (and various others) will be given a more precise analysis in subsequent chapters.

Some authors have criticized the possibility of clashes in maxim-based pragmatic theories. For instance, according to Davis (1998) clashes compromise the predictive power of the Gricean approach; and Sperber and Wilson in part motivate their aim to reduce the maxims to a single principle as follows:

> Any system with more than one pragmatic principle must provide some account of their interaction – an account which is rarely provided. In our framework, with its single principle, there is no possibility of clashes.
>
> (Sperber and Wilson 1986a, p.72)

Of course, such criticisms are justified in pragmatic theories that leave the maxims informal and the set of possible clashes indeterminate. But clashes are not intrinsically problematic. Quite the contrary: as I hope to have shown in part already, and continue to show in subsequent chapters, the range of possible maxim violations and hence the range of clashes are useful notions in a theory of intonational meaning, i.e., the ICM theory. Indeed, even though (lest we forget) the maxims themselves and hence their violations and clashes are all primarily theory-internal notions, their usefulness might tempt one to say that they are "real", in some sense.

Chapter 9

An account of rising declaratives

1 Aims of this chapter

In chapter 7 we already encountered the following example (there (12), originally from Gunlogson 2003):

(1) *(B sees A enter the room with an umbrella.)*
B: It's raining?
H* H%

The uttered sentence has syntactic declarative mood, which is characteristic of assertions, but the utterance feels more like a question, e.g., in written form it is quite naturally punctuated with a question mark. Similar examples in the literature may have a low (L*) or rising (L*H) accent, i.e., as long as the accent is not falling: the overall contour must be a rise. I will refer to such utterances as "rising declaratives", though I will sometimes add "of the relevant sort" because not all rising declaratives belong to the intuitive subclass that existing accounts of examples like (1) have tried to capture. (An alternative term would be "declarative question", but I have already used question in the more technical sense of utterances of interrogative sentences; e.g., in my assumption in chapter 6 that questions lack a main informational intent.)

The current chapter presents a detailed analysis of rising declaratives like (1) within the ICM theory outlined in the previous chapters. It will explain three known aspects of rising declaratives of the relevant sort (e.g., Gunlogson, 2008):

(i) **question-likeness:** rising declaratives of the relevant sort intuitively feel like questions about the truth of the proposition expressed (e.g., they do not commit the speaker to its truth);

(ii) **speaker bias:** they express an epistemic bias in favor of the proposition expressed, i.e., the speaker must consider it likely; and

(iii) **badness out of the blue:** they are strange without appropriate contextual setup, e.g., a preceding utterance or other event introducing the topic.

I take aspect (i) to characterize, informally, which rising declaratives are "of the relevant sort". Aspects (ii) and (iii) are also quite clearly true of (1), but this does not suffice to show that they are true of all rising declaratives of the relevant sort. To make it plausible that aspects (ii) and (iii) are also generally necessary, we must consider cases where either speaker bias or contextual setup is absent, and witness that rising declaratives are strange.

For instance, in the following example speaker bias is possible but contextual setup is denied (adopted from (6) in Gunlogson 2008):

(2) *(Gina to her officemate Harry, with no contextual setup:)*
  a. G: Is the weather supposed to be good this weekend?
  b. (?) G: The weather's supposed to be good this weekend? (H%)

As Gunlogson notes, the interrogative (2a) is fine out of the blue, but the rising declarative (2b) is strange. The felicity of (2a) means that the strangeness of (2b) cannot be due to its question-likeness (i.e., aspect (i)). Nor can it be due to the supposedly required speaker bias (i.e., aspect (ii)), since the example does not prevent us from imagining one – for instance, Gina may be expecting good weather on the basis of yesterday's long-term forecast. Indeed, Gunlogson notes that other types of biased, question-like utterances are perfectly fine in (2), e.g., "Isn't the weather supposed to be good this weekend?" (Gunlogson's (7)). Hence, it appears that the strangeness of (2b) is due to the explicit denial of contextual setup, i.e., aspect (iii). Unsurprisingly, the rising declarative in (2b) improves if some contextual setup is allowed, e.g., if we let Gina notice that Harry is reading the weather forecast.

The next example presents the reverse situation; this time the speaker bias is explicitly denied (by Gina herself), whereas the required contextual setup is present:

(3) *(The weather's been horrible lately. Gina to her officemate Harry, whom she sees reading the weather forecast:)*
  G: Oh, I haven't read a forecast in days! I have no idea...
  a. ...is it supposed to be good this weekend?
  b. (?) ...it's supposed to be good this weekend? (H%)

It seems to me that (3b) is strange. Assuming again that appropriateness conditions on rising declaratives could be accommodated if compatible with the given context, the strangeness of (3b) can be blamed only on the impossibility of accommodating a bias, providing support for the necessity of aspect (ii). Indeed, a biased question like "isn't the weather supposed to be good this weekend?" seems to me equally strange here. These judgments are in line with Gunlogson's (2003) claim that rising declaratives are strange if the speaker is ignorant or has to be neutral.

Actually, Gunlogson's own evidence for the supposed bias of rising declaratives is not entirely convincing. She notes (in Gunlogson 2003; Gunlogson 2008) that rising declaratives are strange in contexts like police hearings and examinations, in which the questioner may indeed be supposed to be ignorant or neutral. However, these seem to be settings in which, also, questions tend to be asked without much regard for prior context. This means that the strangeness of rising declaratives in such settings could in principle be blamed on aspect (iii), in which case it would provide no independent support for aspect (ii). Similarly, the fact that rising declaratives, as Gunlogson (2003) notes, are strange on requests (e.g., "you could please pass me the salt?"), need not be due to the inappropriateness of biased requests – perhaps it shows that requests tend not to be evoked by the context (I do not know if this is plausible, but it seems to me possible).

More generally, I am unaware of examples in the literature that show the necessity of speaker bias independently of contextual setup, i.e., evidence for aspect (ii) independently of aspect (iii). This means that my empirical ground for assuming that aspect (ii) is necessary for rising declaratives of the relevant sort is limited to 1. my own judgment with regard to (3), which I shall assume is representative, and 2. the general intuitions of most of the aforementioned authors, which I shall take seriously even if these authors did not quite succeed at isolating the source of their intuition.

Although I will postpone a discussion of this matter to the end of this chapter, let me note here that the necessity of a speaker bias (aspect (ii)) for rising declaratives of the relevant sort has recently been called into question by Farkas and Roelofsen (2015), on the basis of several examples including the following:

(4) Student: [...] because the square root of 9 is 2 and $2 + 3$ is 5.
Teacher: The square root of 9 is 2? (H%)

Clearly, the teacher cannot be genuinely biased in favor of the square root being 2. However, I don't think that examples like this one, or the other examples considered by Farkas and Roelofsen, really pose a threat to the generalization that rising declaratives of the relevant sort normally express a speaker bias. I will return to this towards the end of this chapter.

Lastly, several authors assume that the bias itself must be triggered by the context, thus conflating aspects (ii) and (iii) (e.g., Gunlogson 2003; Trinh and Crnič 2011; Malamud and Stephenson 2015). Indeed, this may appear to be suggested by example (1) above: A's entering the room with an umbrella accounts for both the source of B's bias and the required contextual setup. But as Poschmann (2008) notes, this need not be the case (and Gunlogson (2008) agrees; for more evidence see Northrup (2014, p.162)); for instance, she notes that the bias in the following scenario is private (adapted from Beun 2000):

(5) *(On the phone.)*
Agent: Schiphol Information.

Caller: Hello, this is G.M. I have to go to Helsinki, from Amsterdam. Can you tell me which flights leave next Sunday?

Agent: Just a moment. ... Yes, there are several flights. One leaves at 9.10, one at 11.10, and one at 17.30.

Caller: The flight takes about three hours? (H%)

Here the caller seems to be recalling the flight duration from memory. What is contextually triggered is not the speaker's bias, but merely, say, the topic of flight duration. This suggests that aspects (ii) and (iii) must be considered distinct, and an account of rising declaratives should account for each of them (along with aspect (i)).

Outline Section 2 presents the ICM-based account in detail. Section 3 discusses existing accounts of rising declaratives of the relevant sort, among which there is considerable variation (e.g., Gunlogson, 2003; Gunlogson, 2008; Truckenbrodt, 2006; Nilsenova, 2006; Trinh and Crnič, 2011; Malamud and Stephenson, 2015; Farkas and Roelofsen, 2015; Krifka, to appear). As I will show, although the ICM-based account generates the core of some existing accounts, none of the existing accounts is entirely satisfactory, and none quite as explanatory. Section 4 concludes.

2 An ICM-based account

I assume that rising declaratives have a main informational intent, i.e., that they are assertions in a sense, unlike "genuine" (interrogative) questions (see chapter 6, and mainly chapter 12):

9.1. Assumption. Rising declaratives of the relevant sort (like declaratives more generally) normally convey a main informational intent.

I assume that the main informational intent p_0 of (1) given above is simply the proposition that it is raining ($^{\wedge}R$). An additional intent (p_3, somewhat arbitrarily) is conveyed by the high boundary tone, according to the ICM theory:

$p_0 = {}^{\wedge}R \qquad p_3 = {}^{\wedge}\neg\Box\,\textsc{Maxims}(\mathcal{T}_0)$

Themes, attentional intents and contents are omitted. Based on these assumptions, I will first show that the maxim that is to blame for the truth of p_3 is I-Quality, and then explain how this may account for the three features of rising declaratives identified above.

2.1 An I-Quality suspension

Intuitively, rising declaratives can be understood as involving an I-Quality suspension: the speaker does not take herself to know that the intent p_0 is true. We must explain how this can be derived from the assumed intents. Most importantly, in chapter 8 I assumed that maxims are suspended only in case of a clash, and only few clashes are possible when thematic competence holds, i.e., when the speaker knows what the theme is. Let us assume that this is the case in (1), i.e., that it is clear to B that a relevant thing to comment on given A's umbrella-tinted entrance is the weather, or the rain more specifically.

If thematic competence holds then the only possible clashes are between I-Quality and I-Relation and clashes involving I/A-Clarity or Manner-Clarity. The latter can be ruled out, given the simplicity of B's utterance in (1), if we assume that A and B are fluent in English, and that there is no background noise that may compromise clear communication. This leaves only a (truth-uncertain or hopeless) clash between I-Quality and I-Relation: there is nothing that B takes to be both true and (even potentially) thematic relative to the main theme. (I will shortly consider cases in which these assumptions, i.e., thematic competence and fluency in English, do not hold, and in which rising indicatives indeed seem to have different uses.)

An I-Quality/I-Relation clash of this sort can be coped with in several ways, namely by:

a. conveying something true but athematic (violating I-Relation);

b. conveying something thematic but potentially false (suspending I-Quality);

c. switching to a different theme that can be compliantly addressed; or

d. giving up the informational intent and making a merely attentional contribution, that is, asking an (interrogative) question (cf. chapters 6 and 12).

Option c. is not possible in (1), given the high boundary tone, and neither is option d., given that the sentence has declarative mood. That leaves only options a. and b. i.e., violating I-Relation or suspending I-Quality. The only informational intent of (1) that is prominent enough to be addressing the main theme is p_0, so this must be the intent that either violates I-Relation or suspends I-Quality:

$$\neg\Box\,\text{I-}\textsc{Relation}(p_0, \mathcal{T}_0) \vee \neg\Box\,\text{I-}\textsc{Quality}(p_0)$$

By filling in what the maxims require, and given thematic competence and negative introspection, this implies that either the rain is not thematic, or the speaker must not believe that it is raining, i.e.:

$$\neg\mathcal{T}_0(^\wedge R) \vee \neg\Box R$$

This result is not framed as a "Fact" because its proof relies on informal parts of the theory, such as assumption 8.1 about clashes and considerations of clarity and

prominence; but the formalized components of the above derivation were proven in chapter 8.

Now, it is unlikely that the rain would be athematic in (1). The only theme that an audience could arguably understand speaker B to be addressing, given the context and especially her intent, is a theme about the weather, so addressing any other theme (i.e., one such that the rain is athematic) would have violated Compliance Transparency, i.e., the addressee A would not have been able to understand the theme. In chapter 8 I assumed that there is no clash that would warrant such a violation. It follows that the high boundary tone in (1) can quite safely be blamed on an I-Quality suspension, i.e., $\neg\Box R$, and this is what we sought to derive. It follows also that the responsible I-Relation/I-Quality clash must have been a truth-uncertain one.

Some alternative uses, and paralinguistic cues The foregoing derivation relied on assumptions of thematic competence and fluency, and this predicts that rising declaratives may have different (i.e., not I-Quality-suspending) uses when these assumptions are false. Indeed, in chapter 7 we already saw three such examples:

(6) M.L.: *(to a receptionist)* Hello, my name is Mark Liberman.
H* H%

(7) *(English tourist in a French café.)*
A: I'd like... err... je veux... a black coffee?
H* H%

(8) *(A isn't sure if B wants to know about neighborliness or suitability for dating.)*
B: What do you think of your new neighbor?
A: He's attractive?
H* H%

Arguably thematic competence does not hold in (6) and the example involves a suspension of I-Quantity ("is this enough information?"); in (7) fluency obviously does not hold and the suspended maxim is instead I-Clarity ("have I made myself clear?"), and (8) suspends at least I-Relation – in each case with analogous suspensions on the attentional side. (The various clashes that may be to blame for these suspensions were identified in chapter 8.)

In practice, disambiguating between these various uses may rely not only on assumptions like thematic competence and fluency, but also, perhaps even primarily, on paralinguistic cues (as stressed in Bolinger 1985). These are some of the cues that I found myself producing for the different examples:

- for (1): raised eyebrows, high final pitch, head slightly withdrawn;

- for (7): uncertain grin, eyebrows not raised, quite high final pitch, head lowered, mouth remains open after speaking; and
- for (6) and (8): eyebrows slightly raised, final pitch not as high, head turned sideways a bit (these cues may not be present in (6) if we imagine it to be a very routine interaction);

These cues may reflect curiosity/surprise in (1), submissiveness or even fear in (7), and tentativeness in (6) and (8). For a much longer list of similar exercises see Bolinger 1985. The upshot is that disambiguating an intonation contour, say, finding out which maxim suspension is to blame, is at least in spoken language not as difficult as it may appear from looking only at the linguistic cues.

2.2 Accounting for the three main features

Taking now as our starting point that (1) involves an I-Quality suspension, let us try to account for the three aspects of rising declaratives given in section 1, namely (i) question-likeness, (ii) speaker bias, and (iii) that they are bad out of the blue.

(i) Question-likeness In the above derivation of an I-Quality suspension, one result was that the rain cannot be athematic. Hence, a conversational goal pursued by B in (1) must be to make it common ground that it is raining. Since B indicates that she does not take herself to know that it is raining (I-Quality suspension), B's utterance is insufficient to make this proposition common ground, hence establishing that it is raining will remain a conversational goal. The Continuity Principle then predicts that this will also be a goal for the next speaker. Moreover, the Pruning Principle predicts that establishing its negation will also be a goal, albeit with lower precedence. This explains why rising declaratives of the relevant sort strongly invite a positive or negative response, and I assume that this is sufficient to account for the feeling that they are question-like.

Indeed, an explanation in the current framework for the question-likeness of *actual* questions, i.e., utterances of interrogatives, is hardly any different: since questions lack a main informational intent (chapter 6) they do not commit the speaker to any main-thematic proposition, but serve only to draw attention to states of affairs worth sharing. Through the Continuity Principle and optionally the Pruning Principle, merely drawing attention to states of affairs will demand a response from the addressee (see also chapter 12).

(ii) Speaker bias Recall that the I-Quality suspension in (1) could only be due to a clash with I-Relation. In order to explain the bias I will assume that I-Quality is more important than I-Relation (in line with Grice 1989; ch.2). Moreover, as I suggested in chapter 2, violating I-Quality by saying something that is probably

true is better than violating it by saying something that is probably or even certainly false. That is:

9.2. Assumption. I-Quality is more important (i.e., compliance more rewarding, violations more costly) than I-Relation; the cost of violating I-Quality is proportional to the probability of the intent being false.

If we conceive of rationality as maximizing expected compliance in a way that takes this assumption into account, it follows that a rational speaker will choose to suspend I-Quality rather than I-Relation only if the probability of the intent being true somehow outweighs the high cost associated with its violation. This could be what explains the bias in (1).

To illustrate, suppose that I-Quality is three times as important as I-Relation. An unsophisticated way of computing expected compliance for these two maxims could then be the following (with prob some probability measure):

$$3 \cdot \mathsf{prob}({}^{\vee}p_0) + 1 \cdot \mathsf{prob}(\mathcal{T}_0(p_0))$$

Now, complying with I-Quality whilst knowingly violating I-Relation yields an expected compliance of 3 (since $3 \cdot 1 + 1 \cdot 0 = 3$). The other option, suspending I-Quality and complying with I-Relation, can yield an expected compliance higher than 3 only if the probability of the intent being true is greater than two thirds (since $3 \cdot \frac{2}{3} + 1 \cdot 1 = 3$), and the greater the difference in importance the higher this threshold. A more insightful fact: if we conceive of a bias very minimally as a greater-than-half probability, then for this unsophisticated way of computing expected compliance to predict that I-Quality suspensions require a bias, I-Quality must be at least twice as important as I-Relation. This seems reasonable, given that violating I-Quality amounts to making no real contribution at all (Grice 1989, p.371; see also Gunlogson ms.).

Thus, the epistemic speaker bias in (1) is potentially explained as follows: since the speaker suspends I-Quality, she must consider the truth of the intent sufficiently likely – otherwise she would have preferred to violate I-Relation instead (a scenario that will be discussed in detail in chapter 11). The precise value of "sufficiently likely", and hence whether this potential explanation can be turned into an actual explanation, will depend on how exactly expected compliance is maximized and on the relative importance of the maxims.

Lastly, as Gunlogson (2008) notes, real (i.e., interrogative) questions – at least of the plain, sentential, rising variety – do not express a comparable bias (see example (3) given at the start of this chapter). Indeed, none of the foregoing considerations applies to questions, which lack an informational intent and to which the I-maxims arguably do not apply – see chapter 12 for the core predictions of the ICM theory with regard to interrogative questions.

(iii) Badness out of the blue As I mentioned above, one way of coping with a clash between I-maxims is to simply avoid it by not trying to make an informational contribution at all, namely by asking a "genuine" (interrogative) question (the precise way in which asking an interrogative avoids an I-Quality suspension will be made more clear in chapter 12). This suggests that rising declaratives are bad out of the blue precisely because interrogative questions are *perfect* out of the blue, and because in addition a rational speaker will not risk asserting a falsehood (by means of a rising declarative) if uttering an interrogative question is a perfect alternative. Of course this raises the new issue of why rising declaratives of the relevant sort (and certain other sorts) exist at all – apparently, interrogative questions are not always a valid alternative to a rising declarative. (Strictly speaking, to explain why rising declaratives exist at all we must also explain why an I-Quality/I-Relation clash is not normally coped with by simply switching to a different theme – apparently the Continuity Principle is sufficiently strong to prevent this. But note that an explanation of this fact is not strictly necessary for an account of why rising declaratives are bad out of the blue.)

To address the remaining issue of why rising declaratives can be rationally uttered at all, I assume that interrogative questions, while perfect out of the blue, are not so good if the theme they address has already been evoked:

9.3. Assumption. A rational speaker will make a purely attentional (i.e., non-informational) contribution only if it serves to introduce new conversational goals to the conversation, or to highlight pre-existing goals that would otherwise seem to disappear.

Formalizing assumption 9.3 would require a formal theme-pragmatics, and perhaps an additional A-maxim that interacts with theme-pragmatics in a way that goes beyond a single theme (it may require a formalized notion of attentional state, as found for instance in Bledin and Rawlins 2016). This is something I leave for the future; for present purposes the informal assumption will suffice. (Assumption 9.3 will be relied upon also in chapter 12, interestingly, for explaining a speaker bias in the case of falling (interrogative) questions.)

Something like assumption 9.3 appears to be independently necessary, for instance to explain why it is inappropriate to simply repeat a question that one is unable to resolve (except perhaps as a way of repeating it to oneself to let it sink in, but I will set this aside as a different type of language use):

(9) A: Hey B. Was John at the party, or Mary?
B: (?) Was John at the party, or Mary?
A: Er...

This is ruled out by assumption 9.3; but the second disjunct in the assumption ensures that echoic questions like the following are allowed:

(10) A: John was at the party.
B: Was he?

This is fine because B's purely attentional contribution serves to maintain a goal that would otherwise appear achieved by A's assertion, with the effect of asking for further confirmation, perhaps rhetorically to indicate surprise.

A consequence of assumption 9.3 is that interrogative questions are dispreferred if the theme they address has just been introduced by a preceding utterance, as in (9), but also if it has just been evoked by an extralinguistic event like the arrival in (1) of someone with an umbrella. (I will not in this dissertation try to characterize the ways in which extralinguistic events may evoke themes, a matter that may be as complex as the presupposed theory of goals.) Consider the following variant of (1) where B asks an interrogative question instead uttering a rising declarative:

(11) *(B sees A enter the room with an umbrella.)*
B: Is it raining?
H* H%

Assumption 9.3 predicts that B's question in (11) can be felicitous in the following two circumstances:

a. B does not consider the theme to have been evoked by A's entrance, i.e., it is just something she wants to know independently. In this case A might get the impression that B did not notice his umbrella.

b. Regardless of the source of the theme, B considers A's entrance with an umbrella to have fully resolved it, and utters (11) in a rhetorical way to indicate surprise, basically like the echoic question in (10).

The more obvious A's umbrella – and let us also add a bright yellow, dripping wet raincoat – the less likely scenario a. and the more likely the surprise implication of scenario b. Crucially, however, assumption 9.3 predicts a third circumstance in which the question in (11) *isn't* felicitous:

c. B considers the theme to have been evoked by A's entrance, and does not take A's entrance with an umbrella to have fully resolved it, either genuinely or feigned for rhetorical purposes (with an effect of surprise similar to scenario b.).

In this scenario asking an interrogative question is not an option, so this is where a rising declarative may occur (at least if B is sufficiently biased), i.e., this is what the situation in (1) must be like. As Gunlogson (2008, p.120) notes, the presence of wet rain gear results in a greater improvement of a rising declarative like (1) than, say, the mere presence of a window, presumably because wet rain gear is more likely to evoke the required theme.

The foregoing explanation relies on the assumption that the only valid alternative to a rising declarative is its interrogative counterpart, so that the unavailability of the latter improves the former. (Chapter 12 presents an account of questions as *opting out* of the I-maxims, which allows this to be restated as follows: the only way to avoid an I-Quality suspension/violation is to opt out of it.) But clearly there are other things the speaker in (1)/(11) could have uttered, instead of either the rising declarative or the corresponding interrogative, e.g.:

(12) a. Isn't it raining?
b. It's raining, isn't it?
c. I wonder if it's raining.
d. It seems like it's raining.
e. Please wipe your feet when entering.

For the foregoing explanation to go through, these alternatives (among many others) must, for some reason, not count as valid ways of avoiding an I-Quality suspension, unlike the plain, positive interrogative. I will here sketch why this may be the case for the examples in (12); some other potential alternatives will be discussed in chapter 11 (namely utterances that cope with an I-Quality/I-Relation clash by pursuing a *strategy*).

For (12c,d,e) an explanation is that their themes are simply different from the theme underlying the rising declarative, and that, understandably, changing the theme is not always an acceptable way of avoiding an I-Quality suspension (though sometimes it may be). For (12a) the reason may likewise be that it involves a theme-shift: the theme of a negative question must contain the negative proposition, but this need not be (and perhaps cannot be, for reasons I will omit) an element of the theme of the (positive) rising declarative. (And the theme shift required for (12a) is even greater if we assume, following Reese 2007, that the negation in (12a) is *metalinguistic*, i.e., that (12a) is not about the weather but about what one would say about the weather; cf. chapter 11.) Lastly, the tag question in (12b) may not be a valid alternative to the rising declarative because, as Farkas and Roelofsen (2015) note, it implies a stronger speaker commitment to the expressed proposition, a fact that may be explained by regarding a tag question as a (perhaps conventionalized) sequence of a plain, falling assertion followed by an invitation to agree (see Farkas and Roelofsen for one possible way in which the supposedly conventionalized contribution of this two-part construction may be modeled).

In sum, rising declaratives are bad out of the blue but sometimes fine otherwise, because the corresponding interrogatives are fine out of the blue and sometimes bad otherwise, and because, plausibly, rising declaratives and the corresponding interrogatives are the only ways to avoid commitment without changing the theme. The fact that interrogatives are sometimes bad was explained in terms of an arguably independently necessary constraint on purely attentional contributions,

i.e., assumption 9.3, which states basically that such contributions must have an effect on the set of public conversational goals. (In chapter 12 on question intonation I will again rely on assumption 9.3, namely on the general consequence that questions typically serve to introduce new themes to a conversation.)

3 Comparison to existing accounts

There is considerable variation among existing accounts of rising declaratives of the relevant sort. Truckenbrodt (2006) analyzes such rising declaratives as expressing a lack of speaker belief in the truth of the proposition conveyed. Nilsenova (2006) proposes that the final rising pitch functions like an epistemic modal "might". Gunlogson (2003) treats rising declaratives of the relevant sort as in some sense committing not the speaker, but the hearer to the main informational intent expressed. Trinh and Crnič (2011) derive a similar treatment from their assumption, shared by Krifka (to appear), that rising declaratives express a proposal for the addressee to assert something, in which case the addressee must be deemed in a position to make that assertion. Gunlogson (2008) treats rising declaratives in general as *contingent discourse moves* (as mentioned earlier, in section 3), with rising declaratives of the relevant sort expressing a *contingent commitment* of the speaker to the proposition expressed, namely, contingent upon some subsequent utterance. The latter is essentially adopted in Malamud and Stephenson 2015. According to Farkas and Roelofsen (2015), a rising declarative introduces a question, requires some evidence for the mentioned proposition, and expresses zero or (at most) low speaker commitment ("credence").

Below I will discuss three of these accounts in some detail:

1. the account in Truckenbrodt 2006, because it shares with the current account its core assumption that rising declaratives of the relevant sort express a lack of belief ($\neg\Box^{\vee}p_0$);

2. the account in Gunlogson 2008, because it is to my awareness the most elaborate and most influential of existing proposals.

3. part of the proposal in Farkas and Roelofsen 2015, concentrating on their claim that rising declaratives need not express a bias at all.

For criticism of the earlier account in Gunlogson 2003 I refer to Nilsenova 2006; Poschmann 2008; Gunlogson 2008; Trinh and Crnič 2011. Nilsenova's criticism applies also to Trinh and Crnič 2011 and, as we will see, to Gunlogson 2008, so I will cover it when discussing the latter. The alternative account that Nilsenova develops is criticized by Trinh and Crnič (2011) for failing to distinguish rising declaratives from modal utterances like "it might be raining", which would be rather strange, for instance, in the rain example (1), and for failing to give an adequate explanation of the speaker bias. The account of Krifka (to appear) is

not developed in detail, as a consequence of which, as Farkas and Roelofsen (2015) note, it is not entirely clear how it would account for the phenomena discussed.

More generally, most of the aforementioned accounts can be criticized for being too narrow (exceptions are Gunlogson 2008 and Malamud and Stephenson 2015). Indeed, Nilsenova criticizes Gunlogson 2003 on this ground, and Tyler (2012) in turn criticizes Nilsenova's account in a similar way. The reason is that most accounts concentrate on a subclass of uses of rising declaratives that does not include cases like (6), (7) and (8) given earlier. But perhaps this sort of criticism is not entirely fair: the rising declaratives on which most existing accounts concentrate do seem to form an intuitively coherent subclass (cf. generalist vs. specialist accounts, chapter 7). An advantage of the ICM theory is that it does justice to this intuitive subclass, i.e., the cases where a high right boundary tone can be blamed on an I-Quality suspension, while also allowing for uses that correspond to the other maxims *and* providing some handles for predicting when different uses may occur.

3.1 Truckenbrodt (2006)

The account in Truckenbrodt 2006 is based on the assumption that rising declaratives convey a lack of belief in the proposition expressed ($\neg\Box^{\vee}p_0$). This corresponds exactly to the effect of an I-Quality suspension predicted by the current approach, though without the notion that it is a maxim suspension. Truckenbrodt does not consider why rising declaratives would be bad out of the blue, but he does try to explain the bias.

To that end Truckenbrodt assumes that indicative sentences express a *desire* for the informational intent to become common ground. Since desires should be realizable, Truckenbrodt reasons, and the speaker herself is apparently unable to commit to the informational intent, she must consider it possible that the addressee will be able to. This explanation seems to me incomplete: what is needed for a bias is not the mere possible realization of desires, but their *sufficiently probable* realization, and it is unclear what sort of desires would be subject to this constraint. Another problem is that his explanation of the bias would at least intuitively apply to declaratives and interrogatives alike. To prevent this one would have to assume that interrogatives do not express a desire for information to become common ground, which seems strange – presumably people tend to ask questions because they wish to (or pretend to wish to) know something.

It seems, then, that Truckenbrodt is forced to assume a notion of "super-desirability" on top of something like conversational goals or themes, to which for some reason declaratives but not interrogatives would relate. This seems unmotivated and is unnecessary in the current account. For this reason, despite a similar starting point (lack of belief), Truckenbrodt's account of the bias is not entirely satisfactory.

3.2 Gunlogson (2008)

The core of Gunlogson's account consists of two assumptions that are quite close to the current approach:

1. rising declaratives in general express that the utterance is *contingent* on some discourse condition whose identity is determined in context (p.129);

2. rising declaratives of the relevant sort are contingent in the sense that the speaker's *commitment* of the proposition expressed is conditional/contingent on the addressee's subsequent ratification of that proposition (p.129);

As I mentioned in chapter 7, the ICM treatment of high boundary tones can be regarded as a particular way of making existing proposals in terms of something like "incompleteness" or "forward-lookingness" more precise, and it bears the same relation to Gunlogson's assumption 1., i.e., Gunlogson is not very precise about the range of possible discourse conditions.

Her assumption 2. can arguably be derived from the current approach (or Truckenbrodt's, for that matter): if a speaker is uncertain about the truth of the proposition expressed, she cannot have epistemic grounds for rejecting a subsequent answer, whether positive or negative, hence the utterer of a rising declarative is committed to accepting whichever answer the addressee will give. (This is not to say that a plain "yes" or "no" will necessarily be sufficient; she may still demand additional motivation or evidence to ensure that the answer meets her standards of knowledge.) Despite our similar starting points, however, the rest of Gunlogson's approach is very different. I will discuss her account of aspects (ii) and (iii), i.e., the speaker bias of rising declaratives and their badness out of the blue.

(ii) Speaker bias For the bias of rising declaratives Gunlogson invokes two additional assumptions:

3. interrogatives do not express a commitment, not even a contingent commitment, but merely a "prospective dependency" (p.122);

4. commitments, even contingent commitments, but not prospective dependencies, must be backed by some evidence (her "Source Principle", p.117, and subsequent discussion).

Gunlogson's distinction between the contingent commitments conveyed by indicatives and the prospective dependencies conveyed by interrogatives is, to my understanding, purely technical. Gunlogson does not explain why the relevant sort of contingent commitment would necessarily involve a bias. In fact, it seems to me that complete ignorance is a typical reason for being contingently/conditionally committed in an intuitive sense (e.g., "I have absolutely no idea, so I will believe

whatever you will tell me!"). Moreover, Gunlogson does not explain why prospective dependencies would be different in this respect. Hence, to my understanding, assumptions 3. and 4. (together with 2.) are not really an explanation, but only an indirect and somewhat cryptic way of stating the explanandum, namely, that rising declaratives convey a bias while the corresponding interrogatives don't.

(iii) Badness out of the blue To explain why rising declaratives are bad out of the blue Gunlogson makes two further assumptions:

5. declaratives (rising and falling) are acceptable only to the extent that the discourse context is consistent with the inference that the speaker has some evidence for the proposition expressed (p.120; earlier she writes "to the extent that the context *supports* an inference" (my emphasis), but she explains why this is inadequate).

6. a contingent commitment presupposes that the addressee is an *authority* (p.125; though this does not quite follow from her definitions (43) and (44)), or at least more of an authority than the speaker (p.126).

Her wording of assumption 5. may be a bit strong, but the underlying idea is arguably true: what is pragmatically implied by an utterance – whether this is the existence of actual knowledge or a mere bias – must somehow be made to fit with the rest of contextual knowledge, otherwise either the speaker or the addressee must revise beliefs, if ever so slightly. But the role of this assumption in Gunlogson's account is problematic, in the following way.

Gunlogson relies on assumption 5. to explain a contrast between (1) and the variant in (13) which lacks contextual cues and in which the rising declarative is somewhat strange (adapted from Gunlogson's (9)):

(13) *(B is in a windowless room, A enters, though without an umbrella or any other weather-related signs (let's say A is instead carrying a book).)*

a. B: Is it raining?

b. (?) B: It's raining? (H%)

Based on her assumption 5., Gunlogson tries to explain the strangeness of the rising declarative in (13b) by arguing that the lack of windows or wet rain gear makes it impossible for B to have any weather-related evidence at that particular moment. But the latter claim seems to me false (given that for Gunlogson evidence does not imply certainty): the context in (13) does not rule out that, say, a third person C informed B about the approaching storm half an hour earlier. Hence, Gunlogson's account of the strangeness of (13b) does not work. Moreover, her explanation may have some trouble with the fact that both falling declaratives and biased (interrogative) questions would have been fine in (13), as she notes (p.103) for an example that seems to me essentially isomorphic, namely example

(2), to be repeated shortly below. It seems to me that Gunlogson, in her attempt to explain (13), forgot about her earlier conclusion (after Poschmann 2008) that speaker bias and badness out of the blue are two different aspects, i.e., that there is nothing necessarily contextual about the bias.

Gunlogson relies on assumption 6. to give an account of example (2) given in section 1, repeated here:

(2) *(Gina to her officemate Harry, with no contextual setup:)*
  a. Is the weather supposed to be good this weekend?
  b. (?) The weather's supposed to be good this weekend? (H%)

According to Gunlogson, the rising declarative (2b) is bad because the context does not support the inference that the addressee is more of an authority than the speaker on the topic, and this lack of contextual support would make it impossible for an audience to interpret the rising declarative as being of the questioning (i.e., I-Quality-suspending) kind. The plausibility of this proposal is difficult to assess because Gunlogson is not explicit about what other possible interpretations rising declaratives may have, and which ones in particular would be responsible for the purported problematic ambiguity in (2). But at least in the current approach no authority inference appeared to be necessary: I relied primarily on the speaker's thematic competence and fluency (and I also highlighted that paralinguistic cues may suffice to disambiguate even if these assumptions are uncertain).

As for the plausibility of assumption 6. itself, Nilsenova (2006) criticizes a similar ingredient of Gunlogson 2003, citing an example from Gunlogson in which B appears to be merely stating a likely hypothesis, without necessarily expecting A to know more about it than B herself:

(14) A: John has to leave early.
  B: He'll miss the party then? (H%)

Indeed, while problematic for Gunlogson's account, this rising declarative does seem to me "of the relevant sort", because the ICM theory would treat it as involving an I-Quality suspension. More conceptually, assumption 6. is not very plausible except as a mere tendency, say, that rational speakers tend to prefer to pursue conversational goals that are easily achievable and to ask people that most likely have an answer. But as an actual rule it is too strong: certain pieces of information may be so important as to warrant asking people even if they are unlikely to be able to assist (cf. "I'm probably asking the wrong person, but..." in chapter 3).

It is unclear to me why Gunlogson tries to account for (13) and (2) in different ways, namely by means of assumption 5. and 6., respectively. The two examples seem to me isomorphic: both simply show that rising declaratives are bad out of the blue. Indeed, the ICM-based account of this aspect of rising declaratives works for both examples: rising declaratives are fine only if asking an interrogative question would have been strange, namely, if the theme addressed was already

evoked by the context (or at least regarded by the speaker as such), which is precisely what is lacking in (13) and (2) alike. This also explains why, as Gunlogson notes, the rising declarative in (2) improves if Gina sees Harry read the weather section in a newspaper, and in (13) if wet rain gear is added – the relevant themes may then be evoked by the context. In sum, according to my account, what must be supported by the context, in some sense, is not the speaker's evidence (although her having evidence must be deemed *possible*, but this is too weak to really achieve much), nor the addressee's authority, but the theme.

3.3 Farkas and Roelofsen (2016)

According to Farkas and Roelofsen (2015), rising declaratives have the following three features:

1. they are question-like by virtue of their core semantics, which is a set containing both the mentioned proposition and its negation (unlike their attentional intents in the current approach);

2. they imply that the speaker has access to some evidence in favor of the mentioned proposition;

3. they imply that the speaker's "credence" in the mentioned proposition is at most low (i.e., zero to low; p.20).

These ingredients are essentially just stipulated, but Farkas and Roelofsen do propose that negative biased (interrogative) questions and tag questions can be understood in terms of the same types of features, which may increase the relative parsimony of their approach. But I will set their more general ambition aside, and keep the discussion focused on rising declaratives. I will discuss assumption 2. briefly, and assumption 3 in more detail.

Assumption 2. is essentially a more direct version of Gunlogson's (2008) assumption 4. above: it bypasses Gunlogson's auxiliary notion of contingent commitment. The two approaches rely on this assumption in the same way, namely in an attempt to explain the badness of rising declaratives out of the blue – Farkas and Roelofsen (p.37) discuss example (13) given earlier. It follows that both accounts face the same shortcomings in this regard. (Unlike Gunlogson, Farkas and Roelofsen try to partially motivate their assumption, namely by arguing that rising declaratives are "marked", by which they mean "formally[/verbally] more complex or more [...] prone to misinterpretation" than falling declaratives or rising interrogatives (p. 14). According to them, marked expressions must have "special discourse effects", which in the case of rising declaratives would happen to be the requirement of evidence – but they do not explain why this "special effect" would be the way it is.)

Assumption 3. is different from Gunlogson's approach in that it dissociates evidence from actual speaker beliefs (credence), such that rising declaratives do

not imply a genuine speaker bias. This is a deviation from what most other accounts including mine attempt to explain. Farkas and Roelofsen motivate this based on the following examples (their (56), (70), and (79), respectively; they attribute the first to Jeroen Groenendijk):

(15) Student: [...] because the square root of 9 is 2 and $2 + 3$ is 5.
Teacher: The square root of 9 is 2? (H%)

(16) *(A mother asks her child to set the table, and he does a particularly bad job of it, but he appears to consider the chore finished.)*
Mother: This table is set? (H%) Where are the wine glasses? The napkins?

(17) *(Sam is not Bill's son, but the neighbours', and the therapist knows this.)*
Bill: Should I help Sam pay his loans?
Therapist: You are his father? (H%) (No, so you shouldn't help him.)

As Farkas and Roelofsen note, the relevant speakers cannot be genuinely biased in favor of the propositions expressed: the teacher knows that the square root of 9 is not 2, the mother clearly believes that the table is not yet set, and the therapist knows that Bill is not Sam's father. Based on these examples, Farkas and Roelofsen conclude that rising declaratives do not necessarily imply a genuine bias, and they assign a weaker meaning to rising declaratives accordingly: they assume that the speaker should have access to some (potential) evidence, but that the speaker may nevertheless be completely ignorant about the proposition for which this would be evidence (i.e., "credence" may be zero), or even know that the proposition is false.

The weaker meaning that Farkas and Roelofsen assign to rising declaratives may be problematic. For one, to my understanding, they do not currently explain how, on the basis of the weaker meaning, a bias could be predicted when there actually is one. Moreover, it seems to me that their account would wrongly predict that the rising declarative in (3), repeated here, should be fine:

(3) *(The weather's been horrible lately. Gina to her officemate Harry, whom she sees reading the weather forecast:)*
G: Oh, I haven't read a forecast in days! I have no idea...
a. ...is it supposed to be good this weekend?
b. (?) ...it's supposed to be good this weekend? (H%)

After all, Gina's complete ignorance is compatible with her having access to "evidence" that is not in fact evidence (if such a thing exists), or with her having access to two contradictory sources of evidence. Indeed, we could imagine a variant with "John told me that the weather was going to be bad, but Mary told me that it was going to be good, so I really have no idea. [...]" – it seems to me that (3b) would still be somewhat strange (though it should become acceptable if we think of Gina as tentatively choosing a side, even if only temporarily).

Since examples like (3) have not been explicitly discussed in the literature, this potential refutation of Farkas and Roelofsen's approach rests primarily on my own intuition (though more indirectly also on the intuitions of other authors who have claimed that rising declaratives of the relevant sort do express a bias). For this reason I will not press this criticism. Rather, in the remainder of this section, I will briefly argue against Farkas and Roelofsen's conclusion that examples (15), (16) and (17) would be problematic for accounts like mine, i.e., accounts that do generally predict a bias.

Farkas and Roelofsen fail to consider at least two ways in which accounts like mine may try to cope with examples like (15), (16) and (17), namely that these examples could involve (a) pretense or (b) metalinguisticness. I will briefly consider both options.

According to a pretense-based account of (15), the teacher would be pretending not to be an authority, presumably for didactic reasons. (For possible roles of pretense in conversation, see Grice 1989 (1989, ch.2, p.29) on politeness, Clark and Gerrig 1984 on irony, and Northrup 2014 (ch.3) on quiz and rhetorical questions.) This means that the I-Quality suspension of the teacher's utterance must pertain not to the teacher's actual epistemic state but to a pretended one. Accordingly, my account of rising declaratives will predict only a pretended bias, and this prediction may well be accurate (though the pretended bias may be difficult to detect, since it is eclipsed by the more important and in some sense opposite rhetorical effect of a correction). A similar account seems to me plausible for (16), where the scope of the mother's pretense would not be limited to her rising declarative – her subsequent questions cannot be genuine either, for of course she knows where the wine glasses and napkins are. In both cases the adult's pretense would plausibly serve to encourage their younger interlocutors to think for themselves – and it seems to me that pretense may serve a similar function in a therapy session, i.e., (17). Note that pretense would in each case pertain not only to the truth of the intent, but also to the desirability of it becoming common ground.

An account of (15) based on metalinguisticness would consist, rather, in assuming that the teacher's intent can be explicated roughly as follows:

(18) Teacher: {Are you / you are} saying "the square root of 9 is 2"?

Whether according to such an analysis the teacher's original utterance in (15) would count as syntactically declarative or interrogative may depend on one's theory of metalinguisticness – perhaps it should be treated as just a single expression in quotation marks, with underspecified syntactic mood. But if it is a declarative, and if its intent is adequately paraphrased by (18), then my account predicts a bias only in favor of the student's having said "the square root of 9 is 2", *not* in favor of the square root of 9 actually being 2 – and this prediction seems accurate.

Depending on how liberal one's theory of metalinguisticness is, this type of account may also extend to (16) and (17), according to the following paraphrases:

(19) Mother: {Are you / you are} willing to assert "the table is set"?
Therapist: {Are you / you are} meaning to imply "I [Bill] am his father"?

Note that at least the therapist's utterance would also have to involve pretense, on top of the metalinguisticness – after all, the therapist knows that Bill could not have meant to imply it.

I do not think that either pretense or metalinguisticness is currently sufficiently understood for one to be able to weigh the pros and cons. What matters is that both mechanisms are in principle available, and that this undermines Farkas and Roelofsen's criticism of existing accounts. Of course one should not rely too freely on mechanisms that are not yet well understood, like metalinguisticness or pretense, since doing so would compromise the falsifiability of the theory (though not necessarily its *in principle* falsifiability; cf. chapter 13). But if an otherwise explanatory and accurate theory occasionally commits us to relying on mechanisms that we know exist but which are not yet fully understood, then this is no reason to stop pursuing that theory – indeed, the theory itself may then contribute to a better understanding of these mechanisms.

4 Conclusion and outlook

The ICM theory generates a novel account of question-like rising declaratives that is arguably more satisfying and more explanatory than existing approaches. It reproduces from more basic principles the core of certain existing accounts, namely a lack of speaker belief, but conceives of it differently, namely as a suspension of I-Quality. Based on this conception, both the speaker bias expressed by rising declaratives and the fact that they are bad out of the blue could be explained by considering why a rational speaker would suspend such an important maxim rather than violating I-Relation (a possibility to be explored in chapter 11) and rather than avoiding the I-maxims altogether by asking an interrogative question (chapter 12).

Against the background of the core ICM theory, the proposed account of rising declaratives relies on a small number of additional assumptions, but none restricted to the phenomena under consideration, and none, I hope, too controversial (e.g., that I-Quality is more important than I-Relation; that questions must have some effect on the public conversational goals). This means that once the ICM theory is granted, we may get the presented account of rising declaratives practically for free.

Rising declaratives are not the only types of utterances that express a bias. In chapter 12 we will see that falling questions can be understood as expressing a superficially similar bias, though one that will be explained in a very different way.

Other biased types of utterances, such as negative questions and tag questions, which I briefly considered in relation to (12), fall outside the intended scope of this dissertation. For recent work on this more general topic, see for instance the parts of Malamud and Stephenson 2015 and Farkas and Roelofsen 2015 that I did not discuss above, as well as, e.g., Büring and Gunlogson 2000, Gunlogson 2003, Sudo 2013, and Northrup 2014.

Chapter 10

Predictions with regard to list intonation

1 Introduction

The current chapter applies the ICM theory to several intonation contours that may occur on what are intuitively lists – say, utterances consisting of at least two coordinated phrases. We already encountered a possible list intonation in chapter 8 (example (4) there):

(1) John was there, Mary was there, and Bill was there.
L*H H% L*H H% H*L L%

Although this intonation is very commonly used for lists (Ladd, 1980, p.183), it is not the only possibility. Both "half-completed" rises (2a) and level contours (2c) are typical list intonations in English (*ibid.*; Gussenhoven 2004, p.299) – and I assume that half-completed falls (2b) are fine as well (this has been noted at least for Dutch; Swerts, Collier, and Terken 1994):

(2) John was there, Mary was there, ...
a. L*H % L*H %
b. H*L % H*L %
c. H* % H* %

List items can also have fall-rise intonation (e.g., Ward and Hirschberg, 1985):

(3) John was there, Mary was there, and Bill was there.
H*L H% H*L H% H*L L%

And even plain falling contours can occur within a list, as in the following example (from Gussenhoven 1984, p.212; my transcription of his transcription):

(4) Loose women, ponces, loud parties, cocaine, runaway kids...
H*L L% H*L L% H*L L% H*L L% H*L L%
You name it, they've got it!
L*H H% H*L L%

A theory of intonational meaning should predict that each of these various contours may indeed occur on a list, as well as account for differences in meaning/use.

This chapter presents the core predictions of the ICM theory with regard to the above contours. I will try to establish the plausibility of most of these predictions by reference to existing characterizations and empirical findings in the literature. However, for some of the predictions no relevant empirical studies exist (to my awareness), hence those will be merely stated and illustrated. I hope that this dissertation as a whole lends the ICM theory sufficient credit for such predictions to serve as plausible hypotheses for future empirical work.

One reason for concentrating on list intonation is that it lets us take a closer look at a component of the ICM theory that has not thus far played a prominent role: that boundary tones indicate (non-)compliance of the utterance *thus far*, and that trailing tones do so *up to the next subsequent boundary tone*. To make this component more precise, and the resulting predictions clearer, I will slightly extend the formal framework, building on *dynamic logic*, in order to be able to jointly represent the intonational intents of utterances with multiple intonation phrases (in chapter 7 this was left informal).

Another reason for concentrating on list intonation is that it is quite a central topic in the literature, but to my awareness no semantic/pragmatic account exists that is both reasonably precise and reasonably general (i.e., that applies to the various contours given above). In the remainder of this introductory section I will briefly discuss a number of existing approaches.

Existing work The use of rising intonation on prefinal list items, as in (1), fits well with the generalist accounts discussed in chapter 7 according to which rises would indicate that the utterance is "unfinished", "forward-looking" or "continuation-dependent" (e.g., Bolinger, 1982; Pierrehumbert and Hirschberg, 1990; Bartels, 1999). Although the ICM theory is in a sense a refinement of these accounts – i.e., the maxims spell out the ways in which an utterance can be relevantly unfinished – it remains to be seen how the resulting, more precise meanings of ICM can account for lists like (1). This feature of the ICM theory, i.e., that literal unfinishedness must somehow be derived from a more refined meaning, is shared by the account of Gussenhoven (1984), who proposes that "unfinishedness" is a "metaphorical orientation" of the basic meaning that he assigns to rising contours, i.e., "testing" – but the notion of metaphor is not made very precise.

Empirical studies have to my awareness focused on particular intonational features rather than their interactions in a larger contour. For instance, Wichmann and Caspers (2001) and Gravano (2009) find that level boundaries are *turn-holding cues* while both high and low boundaries are *turn-yielding cues*; Kügler (2007) finds that in German a complete rise (L*H H%) may typically occur in a list of sentences whereas a half-completed rise (L*H %) tends to signal continuation within a sentence, and perhaps the same may hold for English. Such findings must of course be accounted for, but they do not provide a complete picture of the differences between the various contours given above.

Formal semantic/pragmatic accounts of list intonation have mostly concentrated on the exhaustivity effects associated with the final boundary tone of a list (primarily Zimmermann 2000). For instance, whereas (1) seems to imply that no one else was there, this implication can be absent on some interpretations of the following variant with a rise at the end:

(5) John was there, Mary was there, and Bill was there...
L*H H% L*H H% L*H H%

Zimmermann assumes that a list-final fall contributes a wide-scope "closure operator" to the compositional semantics, which turns the main informational content of the sentence into something exhaustive – so it is more a description than an explanation. That the presence/absence of an exhaustivity implication depends on the final boundary tone is of course predicted by the ICM theory, where a fall conveys compliance with, among other maxims, A-Quantity, and a rise may (but need not) be blamed on its suspension. But this topic is not particular to lists, and for this reason I will mostly set it aside in the remainder of this chapter. (In principle, list variants can be constructed of the various rising declaratives in chapter 9, resulting in lists where a final high boundary tone does not necessarily indicate non-exhaustivity, but rather uncertainty about the relevance, clarity or truth of the list items.)

Zimmermann's basic assumption that a list-final fall would contribute a closure operator, though not his precise implementation, has more recently been adopted in accounts of disjunctive questions (e.g., Beck and Kim 2006; Roelofsen and Van Gool 2010; Biezma and Rawlins 2012). Some of these will be discussed in detail in chapter 12 on question intonation. Some of these accounts consider also the role of accent placement, in particular whether each disjunct in a list contains an accent or only the last one. Since the ICM theory does not contribute anything new as far as accent placement goes (as explained in chapter 7), I will also set this aspect of list intonation aside – even though the ICM theory can yield detailed predictions when combined with even a simplistic theory of accent placement. In the contours given above each list item contains an accent.

Lastly, Wagner (2010) presents a detailed account of the relation between boundary strengths and bracketing in lists, but this too is an aspect of intonation about which the ICM theory is silent. Although the ICM theory and Wagner's

account of boundary strength could in principle be combined, I will here set this aspect of intonation aside.

Outline Section 2 presents a simple formalization of "utterance parts" (or "the utterance thus far") as referred to by the ICM theory. Section 3 presents and discusses the predictions of the ICM theory with regard to rising or level prefinal boundaries – what appear to be the most typical list intonations – and section 4 does the same with regard to falling and rise-falling boundaries. Section 5 concludes.

2 Formalizing utterance parts

Consider again the following list:

(1) B: John was there, Mary was there, and Sue was there.
L*H H% L*H H% H*L L%

According to the ICM theory the first boundary tone indicates non-compliance of the first list item; the second boundary tone non-compliance of the first two items combined, and the third indicates compliance of the list as a whole. According to assumption 7.2 of chapter 7 this is to be formulated as follows:

$p_3 = {}^\wedge\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$ (in a model of the utterance up to the first H%)
$p_4 = {}^\wedge\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$ (in a model of the utterance up to the second H%)
$p_5 = {}^\wedge\Box\,\textsc{Maxims}(\mathcal{T}_0))$ (in a model of the utterance up to the final L%)

As the parentheses show, we cannot jointly represent the intents contributed by the different boundary tones in a single utterance model. The reason is that an utterance model in its entirety just represents one (part of an) utterance, i.e., there are no entities *within* an utterance model that represent utterances or their parts. This representational poverty is self-imposed, in part for reasons of simplicity but primarily because it helps one to adopt a speaker-centered view (chapter 2). Nevertheless, for the purposes of this chapter it will be useful to slightly enrich the formalism.

I will enrich the formalism by adding components of a *dynamic logic* (e.g., Pratt 1976, and much subsequent work in computer science, linguistics and philosophy). A dynamic logic extends an "ordinary" logic by adding expressions of the form $[\alpha]\varphi$, which are to be read as "immediately after executing the action/update α, the formula φ is true". These actions are modeled as relations on the set of worlds, where a pair of worlds $\langle w, w'\rangle$ is in the relation for a particular action if executing that action in world w may change the world into w'. I will not define a complete model-theoretic interpretation, but I will make explicit just enough for us to be able to semi-formally derive some predictions of interest.

For current purposes the relevant type of action is the enunciation of a certain part of an utterance. Let expressions $\%_i$ (for i a numeral) denote the action of enunciating everything up to the i^{th} right intonation phrase boundary. For instance, the following means that after enunciating everything up to the second boundary, the maxims are not taken to be complied with:

$$[\%_2]\neg\Box\,\textsc{Maxims}(\mathcal{T}_0)$$

Using this formalism the three intents conveyed by the boundary tones in (1) can be formulated as follows:

$p_3 = {}^\wedge([\%_1]\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$
$p_4 = {}^\wedge([\%_2]\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$
$p_5 = {}^\wedge([\%_3]\Box\,\textsc{Maxims}(\mathcal{T}_0))$

Unlike the first rendition of these intents given earlier, this new formalization can be evaluated within a single, dynamic utterance model.

The action of uttering a certain intonation phrase can be modeled at various levels of description/abstraction. A low-level effect could be the coming into existence of certain sound waves, but this is not immediately relevant for current purposes. What is more relevant is that enunciating some part of an utterance will update the hearer's knowledge state: the hearer will learn a bit more about the semantic contents of the sentence, and thereby ideally about the intents of the utterance. This type of epistemic effect of actions is studied in *Dynamic Epistemic Logic* (DEL; for an overview see Van Ditmarsch, Van der Hoek, and Kooi 2007). The central type of action in DEL is a "public observation" (or "public announcement", which is a more common term, but Pacuit (2013) notes that it is less adequate). For present purposes, utterances can be modeled as public observations of their contents (their nature, not their truth):

10.1. Assumption. **Utterances as public observations:**
The main effect of enunciating (some part of) an utterance is that the nature of its semantic contents is (partially) publicly observed.

For instance, in an appropriately dynamized utterance model for (1), the action denoted by $\%_1$ (i.e., enunciating the first list item) should have the effect that the addressee learns that the semantic content will somehow be composed using the content of the first list item ${}^\wedge Pj$ – but I will continue to leave the details of the presupposed semantic theory implicit. Ideally, the audience's observation of the contents of the entire utterance (i.e., after $\%_3$) will lead also to the audience's recognition of the *intents* – and it is these intents that correspond to what is "publicly announced" in a more intuitive sense.

I refer to the literature on Dynamic Epistemic Logic for possible formal implementations of the foregoing. Such implementations typically ensure that

nothing changes *except* what changes as a consequence of the public observation. The following special instance of this is worth making explicit:

10.2. Assumption. **Intent/theme constancy:**
Normally, themes and intents remain the same throughout an utterance.

Formally, this means that the action of enunciating some part of an utterance, e.g., $\%_2$, can turn a world w into a world w' only if the constants $\mathscr{I}$, $\mathscr{A}$ and $\mathscr{T}$ receive the same interpretation in both worlds. This is a normality assumption, comparable to the belief axioms (KD45), as well as semantic competence and intent introspection (chapter 2): it states, in effect, that a speaker will not normally change her mind in mid-utterance. Of course this normality assumption will not always be true – and below we will see an example where it arguably isn't.

3 High or level internal boundaries

3.1 High internal boundaries

Consider again (1), repeated here with some of the intents predicted by ICM, phrased in the newly extended formalism:

(1) John was there, Mary was there, and Bill was there.
L*H H% L*H H% H*L L%

$p_0 = {}^\wedge Pjmb \qquad \mathcal{A}_0 = \{{}^\wedge Pjmb\} \qquad \mathcal{T}_0 = \{{}^\wedge Pj, {}^\wedge Pm, {}^\wedge Pb\}^\cap$
Intents of the boundary tones:
$p_3 = {}^\wedge([\%_1]\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$
$p_4 = {}^\wedge([\%_2]\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$
$p_5 = {}^\wedge([\%_3]\Box\,\textsc{Maxims}(\mathcal{T}_0))$
Intents of the trailing tones:
$p_6 = {}^\wedge([\%_1]\neg\Box\,\textsc{Maxims}(\mathcal{T}_1))$ ($\mathcal{T}_1$ makes "John" important)
$p_7 = {}^\wedge([\%_2]\neg\Box\,\textsc{Maxims}(\mathcal{T}_2))$ ($\mathcal{T}_2$ makes "Mary" important)
$p_8 = {}^\wedge([\%_3]\Box\,\textsc{Maxims}(\mathcal{T}_3))$ ($\mathcal{T}_3$ makes "Bill" important)

Plausibly the main theme is who was at the party, which would be a theme that makes the three names important. Hence themes $\mathcal{T}_0$ to $\mathcal{T}_3$ may all be the same. In that case the trailing tones serve to convey the same intents as the corresponding boundary tones. In what follows I will therefore ignore p_6, p_7 and p_8.

Now, if the intent p_0 in (1) is taken to comply with I-Quality, I-Relation or I-Quantity at any point in the utterance, it must be taken to comply with these maxims *everywhere*, i.e., regardless of how much has been uttered – and likewise for the corresponding A-maxims (including A-Parsimony). The reason is of course that intents and themes are assumed not to change over the course of an utterance

(assumption 10.2); only the addressee's information about the contents changes. But the same does not hold for I/A-Clarity and Content Efficacy: since through Content Efficacy the addressee's information about the contents may affect her understanding of the intents of the utterance, compliance with I/A-Clarity and Content Efficacy may vary throughout the utterance. This means that if intent p_5 in (1) is true (the final low boundary tone), then the truth of intents p_3 and p_4 (the prefinal high boundary tones) can only be blamed on I/A-Clarity (perhaps together with Content Efficacy). More generally:

10.3. Prediction. In an utterance that ends with a low boundary tone, any (prefinal) high boundary tone can only signal a suspension of I/A-Clarity (perhaps with Content Efficacy): the part of the content expressed up to that point does not (yet) clearly convey the intent.

The responsible clash was identified in chapter 8: the maxims of I/A-Clarity may "clash" on their own, temporarily, if clarity cannot be achieved with a single intonation phrase.

According to this prediction, the meaning of the list-internal high boundary tones in (1) is basically that the utterance is (literally) unfinished. Thus, although in chapter 7 I suggested that ICM can be thought of as making existing characterizations in terms of "unfinishedness" more precise, namely by spelling out the relevant ways in which an utterance may count as unfinished, it now turns out that literal unfinishedness is itself predicted to be one of those relevant ways, at least sometimes.

Prediction 10.3 does not constrain the range of maxims that may be to blame for an utterance-*final* high boundary tone, as in (5) above, repeated here:

(5) John was there, Mary was there, and Bill was there?
L*H H% L*H H% L*H H%

Hence, this contour is predicted to be possible on list variants of basically any rising declarative, e.g., the following variant of (8) in chapter 9, which suspends I-Relation:

(6) *(A isn't sure if B wants to know about neighborliness or suitability for dating.)*
B: What do you think of your new neighbor?
A: He's tall, muscular, and attractive?
L*H H% L*H H% L*H H%

Indeed, this seems to me possible (though it may not be the most natural contour; cf. below). Note that in lists that end high, like (5) and (6), prediction 10.3 does not constrain the range of maxims that may be to blame for the *prefinal* high boundary tones either: if the utterance as a whole suspends an I/A-maxim other than I/A-Clarity, then every part of the utterance will do so too, by virtue of it (normally) having the same intents throughout.

3.2 Level internal boundaries

The level contours given earlier in (2) are repeated here:

(2)

	John was there,		Mary was there, ...	
a.	L*H	%	L*H	%
b.	H*L	%	H*L	%
c.	H*	%	H*	%

I will first and in most detail discuss the theory's predictions for cases where these contours are continued by a third list item that ends with a high or low boundary tone. Towards the end of this subsection I will briefly consider what happens if these lists lack such a continuation, i.e., if they lack a (high or low) boundary tone altogether.

According to the ICM theory, trailing tones indicate (non-)compliance of the utterance up to the next subsequent *high or low* boundary, i.e., level boundaries do not delimit their range. (In chapter 7 I tentatively conceived of this as a (diachronic or pragmatic) consequence of the fact that if compliance relative to *some* theme is worth indicating, it should certainly be worth indicating relative to the *main* theme.) Hence, in lists with level prefinal boundaries, trailing tones are predicted to indicate (non-)compliance of the *entire* utterance, not just the list items on which they occur. For instance, the intents conveyed by the trailing tones in (7a) are the same as those in (7b) – assuming that ellipsis does not make a difference:

(7)

a. John was there, Mary was there, and Bill was there.
H*L % H*L % H*L L%

b. John Mary and Bill.
H*L H*L H*L L%

In both variants, each trailing tone is predicted to indicate compliance of the entire list, just like the final boundary tone. As a consequence, they plausibly all serve to convey basically the same intent, e.g., for (7a):

$p_3 = {}^\wedge[\%_3]\Box\,\textsc{Maxims}(\mathcal{T}_0)$ ($\mathcal{T}_0$ makes "John", "Mary" and "Bill" important.)

And similarly for (7b), but with $[\%_1]$.

Analogously, the intents conveyed by the trailing tones in the following two contours are equivalent – again assuming that ellipsis does not make a difference:

(8)

a. John was there, Mary was there, and Bill was there?
L*H % L*H % L*H H%

b. John (was) Mary (was) and Bill (was)?
L*H L*H L*H H%

Both variants in (8) are predicted to function as a rather ordinary rising declarative (though (8b) without the auxiliary verbs could also be interrogative). That is, the high boundary tone (and high trailing tones) may be blamed on various maxims. In this regard they align with the variant that has high boundary tones throughout, i.e., (5) given earlier. Further below I will consider why a speaker may choose high rather than level boundaries on prefinal list items.

The preceding pairs illustrate a more general prediction:

10.4. Prediction. The intents conveyed by trailing tones in utterances with level boundaries are the same as in the corresponding utterances which lack those boundaries altogether.

This does not mean that the presence/absence of level boundaries may not in some other way affect the use or implications of a contour. For instance, the relative strength of boundaries, i.e., the length of pauses, can serve to disambiguate the bracketing of a list (Wagner, 2010); and prolonged pauses may perhaps give the impression that the speaker is still deliberating about what to say. I suspect that these effects can be accounted for without assuming that level boundaries (i.e., the absence of a boundary tone) serve the communication of an intent. However, this topic falls outside the scope of the ICM theory, and I will set it aside.

We may classify a particular list intonation as "neutral" if it is compatible with the utterance's addressing just a single high-precedence theme, i.e., if the utterance can consist simply in conjoined partial answers to one and the same question. The contours in (7) and (8) are predicted to be neutral in this sense. In contrast, the following variant is predicted to be non-neutral:

(9) (?) John was there, Mary was there, and Bill was there.
L*H % L*H % H*L L%

(The question mark reflects my own judgment: I find it somewhat strange, in a way to be clarified shortly.) Since the prefinal trailing tones indicate non-compliance of the entire utterance, contrary to the final trailing tone and boundary, there must be multiple themes (cf. prediction 11.1 in chapter 11). Hence:

10.5. Prediction. Lists with level prefinal boundaries and mixed trailing tones (like (9)) are not "neutral", in the sense that they must normally involve multiple high-precedence themes.

Presumably, non-neutral contours are less typical, or the appropriate circumstances harder to imagine without some contextual setup. This might explain why, for me, producing the contour in (9) requires more conscious effort, lest I accidentally pronounce either high boundary tones instead of the level boundaries (i.e., (1)),

or low trailing tones instead of the high ones (i.e., (7) above), both of which are neutral contours.

The precise extent to which non-neutral contours like (9) are possible at all is predicted to depend on the ease with which we can imagine a situation in which it would be appropriate. I am inclined to interpret (9) as follows: it seems to me that the speaker is changing her mind in the middle, i.e., initially she did not intend to give an exhaustive list, only halfway realizing that she was able to do so after all. This suggests that I find it easier to give up the normality assumption that intents do not change during an utterance (assumption 10.2) than to imagine the multiple themes that it would otherwise have to address (prediction 10.5). Of course this interpretation of my own judgments amounts to only a very tentative empirical claim.

For the sake of completeness: compared to the level contours with high or low trailing tones, i.e., (2a,b), the contour without trailing tones (2c) is predicted to be more neutral with regard to the type of continuation, i.e., either of the following utterances can address a single theme – the difference being, of course, whether the theme is ultimately compliantly addressed:

(10) a. John was there, Mary was there, and Bill was there.
H* % H* % H*L L%

b. John was there, Mary was there, and Bill was there?
H* % H* % H* H%

The final accents may or may not have trailing tones; as long as these are in line with the respective boundary tones the resulting utterance can still simply address a single theme.

Lastly, let us briefly consider utterances that lack a final high or low boundary tone altogether, like the lists in (2) *without* a third list item. In this case the intents of the trailing tones as stated in the ICM theory are not well-defined: there is no "next subsequent high/low boundary tone" up to which the trailing tones would indicate compliance. For (2c), without trailing tones, this is no problem: it is simply an utterance without any compliance marking (and therefore predicted, in ways to be explained below, to be either very "routine" or improvised and unfinished). But for an account of (2a) and (2b) the assumed intents may have to be reworded in a way that no longer presupposes an *actual* continuation towards a high/low boundary tone, but merely an intended or possible continuation. (Formalizing this may require quantification over (intended) utterance parts. Since utterance parts, as actions in dynamic logic, are relations on possible worlds, this could be achieved, for instance, in two-sorted Type Theory – but I will not currently attempt this.)

With this hypothetical refinement in mind, (2a) could plausibly be predicted to suggest that the speaker at least initially believed that there would be a way to compliantly finish the list, and for (2b) the contrary. Moreover, in both cases

there must be a reason for the speaker not to be uttering the intended or possible continuation, for instance the speaker's inability to do so, a change of mind, or the complete predictability of the intended continuation to an audience (in which case a falling "and so on" might also be appropriate). Since the possible absence of a final boundary tone is not particular to lists, I will not currently explore these predictions in more detail.

3.3 When and where to mark (non-)compliance

We have seen a number of contours that impose roughly the same (non-)compliance conditions on the utterance, which differ only or primarily in when and where (non-)compliance is marked. For instance, the following contours are all compatible with an utterance that non-compliantly addresses a single theme (these were given earlier in (7a), (1) and (10a), respectively).

(11) a. John was there, Mary was there, and Bill was there.
H*L % H*L % H*L L%

b. John was there, Mary was there, and Bill was there.
L*H H% L*H H% H*L L%

c. John was there, Mary was there, and Bill was there.
H* % H* % H*L L%

And a similar triplet can be distilled from the foregoing discussion for contours that end with a rise, namely (8a), (5) and (10b). I will concentrate on the triplet of falling contours in (11). Note that the prediction that these contours impose basically the same (non-)compliance conditions on the utterance is superficially surprising, especially given that the prefinal contours in (11a) and (11b) are phonologically almost each other's opposite.

The contours in (11) differ in where exactly (non-)compliance is marked:

1. with (11a) the speaker indicates compliance of the *entire* utterance early on, but makes no effort to indicate non-compliance (i.e., unfinishedness, by prediction 10.3) anywhere along the way – though of course this is not to say that unfinishedness cannot be inferred from the absence of indications to the contrary (i.e., compliance);

2. the contour in (11b) achieves the opposite: the speaker does not indicate compliance of the entire utterance early on, but rather explicitly indicates non-compliance (unfinishedness) of its parts;

3. with (11c) the speaker does not indicate either compliance or non-compliance (unfinishedness) until the very end.

Now, the maxim of Compliance Transparency is not very precise about when compliance marking is required, and hence about what these differences might entail, but the following assumption seems hard to avoid:

10.6. Assumption. Indicating (non-)compliance of the entire utterance at an early stage is generally good if the speaker is able to, but:

- in some cases indicating non-compliance of utterance *parts* along the way can be more important, and compete; and
- in other cases (non-)compliance does not need to be indicated at all, e.g., if it is sufficiently obvious (or even common ground and hence not thematic to begin with).

This predicts that (11a) is the more neutral contour, while (11b) is particularly emphatic about the prefinal items being incomplete, and (11c) may feel either (i) somewhat *improvised*, as if the speaker did not know in advance exactly how the list would end (this would be an "abnormal" situation in the technical sense), or (ii) somewhat *routine*, which is a possible circumstance in which (non-)compliance would be obvious in advance (but in that case one might expect a level boundary at the end of the list as well, a possibility mentioned above). A similar contrast is predicted with regard to the analogous triple of contours that end with a rise.

The prediction that level boundaries as in (11c) may feel "routine" aligns with existing characterizations of the absence of boundary tones (e.g., Ladd, 1978; Gussenhoven, 1984). However, I am unaware of empirical results that directly corroborate (or falsify) any of the foregoing predictions. Some suggestive evidence is presented in Kügler 2007 (p.68, p.113): in (two varieties of) German, complete rises (L*H H%, as in (11b)) are more typical in lists of complete sentences, whereas rises to a level boundary (L*H %, as in (8a) given earlier) are more typical for sub-sentential (and not necessarily list-like) continuations. This arguably aligns with the foregoing predictions, because it hardly makes sense to actively indicate unfinishedness except for parts that may *seem* finished, i.e., complete sentences. (Kügler only compares the rises, i.e., not the contour in (11a).)

The prediction that the speaker is actively indicating unfinishedness in (11b) but not in (11a,c) may superficially seem to contradict common claims that level boundaries are *turn-holding cues* while high (and low) boundaries are *turn-yielding cues* (e.g., Wichmann and Caspers 2001; Gravano 2009), but this contradiction is only apparent. The high boundary tones in (11b) are predicted to indicate unfinishedness (i.e., an I/A-Clarity violation), which may be worth indicating for reasons other than turn-holding. In fact, high boundary tones are predicted to be rather lousy turn-holding cues: that a prefinal high boundary tone must be blamed on I/A-Clarity is predicted only *given* that it is prefinal, hence this may be understood by an audience only once the speaker continues. Hence, the prediction is that sometimes speakers may wish to stress non-compliance (or unfinishedness) of some part of an utterance for reasons other than turn-holding.

4 Low and fall-rising internal boundaries

4.1 List-internal low boundaries

Consider the list with low internal boundaries in (4) given at the start of this chapter, repeated here:

(4) Loose women, ponces, loud parties, cocaine, runaway kids...
H*L L% H*L L% H*L L% H*L L% H*L L%
You name it, they've got it!
L*H H% H*L L%

Since the first list item already addresses the main theme compliantly (L%), this raises the issue of what purpose is served by subsequent list items. One circumstance in which one may expect an utterance-internal low boundary tone is when the remainder of the utterance merely serves to address a side theme, as is arguably the case in (12):

(12) I spoke to John, who is a very nice guy by the way.
H*L L% H*L H*L L%

However, an analogous analysis for (4) does not seem plausible: the various list items seem to address the same sort of theme, and the first list item is no more central or important than subsequent items. But then, if subsequent items in (4) do not serve a side theme, they must serve their own main themes lest they would serve no purpose at all. It follows that each list item in (4) must be a separate utterance, in the technical sense of each having its own intent and compliantly addressing its own main theme. More generally:

10.7. Prediction. Any continuation after a low boundary tone must either serve to address a side theme, or (typical in the case of lists) be a separate utterance, serving its own main theme.

Therefore, in order to make sense of falling list-internal boundaries, we need a theme-pragmatic explanation for the sequence of themes being addressed.

Making sense of a sequence of themes need not be difficult. For instance, the following sequence can be explained if the speaker happens to be going through a printed checklist:

(13) Switch A is on; switch B is off; switch C is on; [...]
H*L H*L L% H*L H*L L% H*L H*L L%

In a more ordinary narrative, the progression of main themes will not be given in advance but driven by theme-pragmatic principles that invite, say, elaboration, narration or explanation (no such principles have yet been formulated in this dissertation, but see, e.g., Asher and Lascarides 2003), e.g.:

(14) I saw John today. He told me about Mary. They're back together.
H*L L% H*L L% H*L L%

Intuitively this may hardly qualify as a list, but the point is that this example is predicted to exhibit the same essential structure as (13) and (4), i.e., a sequence of multiple utterances with separate main themes. They differ only in the precise nature of the sequence of themes.

For (4), a plausible theme-pragmatic explanation might be that the first list item addresses "what is one bad thing they've got", the second item "what is another bad thing they've got", the third "what is yet another", and so on. A more explicit variant for which this type of analysis seems appropriate is the following:

(15) B: What is one bad thing they've got?
A: Loose women.
B: What else?
A: Ponces.
B: What else?
A: [...]

Perhaps this progression of "what else?"-themes could qualify as a case of "elaboration", in which case (15) would not be so different from (14) as a superficial comparison might seem to suggest. I will leave the formulation of an appropriate theme-pragmatic principle for future work, and take the reasonable naturalness of the explicit variant in (15) to make the existence of a suitable sequence of themes for the single-speaker variant in (4) sufficiently plausible for present purposes (and it is only this existence, not the nature of the themes, that is predicted by the ICM theory).

Still, some further predictions can be derived by reasoning about the themes in (4) on the basis of (15). The "what else?"-themes in (15), and hence the themes supposedly addressed by (4), are arguably what are called "mention-some questions" in the literature: the speaker is not required to give an exhaustive list of bad things, but only to mention some. In chapter 2 I said a little bit about how such questions could be treated in the current approach. Setting aside the details, let us just consider why the speaker in (4) would have chosen to address a sequence of "mention-one" themes rather than, say, a single theme "what are *several* (or even *all*) bad things they've got". (The speaker could have addressed the latter by means of a single utterance, e.g., a list with rising or level internal boundaries). Plausibly, the speaker's choice to address a sequence of "mention-one" themes may imply that, genuinely or rhetorically:

(i) an exhaustive answer cannot (practically) be given or would be beside the point; and

(ii) each answer on its own is sufficient for some extra-linguistic goal, e.g., in the case of (4) to get the police to pay the perceived wrongdoers a visit.

These implications align with the impression I get from (4) and similar examples in the literature. The second implication aligns also with Gussenhoven's (1984) own diagnosis of (4), that the falls are justified because each list item is particularly important (that is, important enough for the items to be immediately made common ground, which is what he assumes the falling contours indicate). Whether the implications (i) and (ii) can indeed be predicted will depend on a future, more precise theme-pragmatic theory.

4.2 List-internal fall-rises

The list with fall-rising boundaries in (3) is repeated here with some of the predicted intents:

(3) John was there, Mary was there, and Bill was there.
H*L H% H*L H% H*L L%

$p_0 = {\wedge}Pjmb$ $\quad \mathcal{A}_0 = \{{\wedge}Pjmb\}$ $\quad \mathcal{T}_0 = \{{\wedge}Pj, {\wedge}Pm, {\wedge}Pb\}^{\cap}$
Intents of the boundary tones (as in (1)):
$p_3 = {\wedge}([\%_1]\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$
$p_4 = {\wedge}([\%_2]\neg\Box\,\textsc{Maxims}(\mathcal{T}_0))$
$p_5 = {\wedge}([\%_3]\Box\,\textsc{Maxims}(\mathcal{T}_0))$
Intents of the trailing tones:
$p_6 = {\wedge}([\%_1]\Box\,\textsc{Maxims}(\mathcal{T}_1))$ ($\mathcal{T}_1$ makes "John" important)
$p_7 = {\wedge}([\%_2]\Box\,\textsc{Maxims}(\mathcal{T}_2))$ ($\mathcal{T}_2$ makes "Mary" important)
$p_8 = {\wedge}([\%_3]\Box\,\textsc{Maxims}(\mathcal{T}_3))$ ($\mathcal{T}_3$ makes "Bill" important)

Unlike the list with plain rising boundaries (1), here at least the first two trailing tones must be making a genuine contribution, namely intents p_6 and p_7; i.e., they cannot be equivalent to the intents of the corresponding boundary tones, p_3 and p_4. Moreover, because the same utterance (or utterance part) cannot both comply and not comply with the maxims relative to the same theme, at least the themes $\mathcal{T}_1$ and $\mathcal{T}_2$ must be genuinely different from the main theme $\mathcal{T}_0$. (This is a core prediction with regard to (rise-)fall-rise intonation, some consequences of which will be explored in detail in chapter 11; see prediction 11.1 there.)

In order to understand the intonation in (3) we must understand which themes the speaker could be addressing (and by means of which intents). In principle, the first two items could be addressing side themes and only the third item the main theme, a use of fall-rise paraphrased by Gussenhoven (1984) as "You with me so far? Now for the main point". (This use of rise-fall-rise will be briefly discussed in chapter 11; e.g., example (5) there.) However, given the uniformity of the list items in (3) such an asymmetrical analysis does not seem plausible here.

A more plausible analysis of (3) involves the Thematic Organization Principle in ways we have seen on several occasions before: for some reason the speaker decided to split the prior theme into three parts and address each with a separate part of the utterance (i.e., a strategy in the sense of Roberts 2012). That such a maneuver should be possible is perhaps suggested by the following, more explicit variant (though whether this variant is predicted to involve three separate themes will depend on the precise intonation contours in ways that I will not presently discuss):

(16) A: Which of our friends were there?
B: Of my friends John, of your friends Mary, and of Sue's friends Bill.

Splitting a theme into separate parts may be a rational, clarity-increasing thematic reorganization if the theme is particularly big and if a natural subdivision exists (e.g., based on whose friends the individuals are). However, it may also serve a more rhetorical purpose: the fall-rise contours in (3), unlike the plain rises in (1), enable the speaker to indicate compliance for each list item separately, and in particular compliance with I-Quality and I-Clarity. This suggests that (3) is quite natural and perhaps preferred after one of the following introductions:

(17) a. But I'm telling the truth! You have to believe me: [...].
b. You're not listening to me; here, I'll tell you one last time: [...].

After the introduction in (17a) the speaker may wish to go on stressing the truth of each list item, and after the introduction in (17b) she may wish to stress the achieved clarity. The contour in (3) is predicted to be particularly suitable for these scenarios (this prediction aligns with my own judgments).

Note that the current, potentially simplifying assumption that utterances have only a single main theme entails that the three sub-themes supposedly addressed by (3) would have to be addressed *in addition to* the overarching main theme, not *instead of* it; a more streamlined analysis becomes available if instead we permit multiple main themes per utterance, and assume that boundary tones indicate compliance relative to *all* main themes. In chapter 7 I already suggested that this may be desirable.

4.3 A remark on disjunctive lists

This is the last prediction to be discussed in the current chapter. A disjunctive list with prefinal fall-rising boundaries (18a) is predicted to be somewhat strange, compared both to its conjunctive counterpart in (3) just discussed, and compared to disjunctive lists with rising accents (18b) or with level boundaries (18c):

(18) a. (?) John was there, (or) Mary was there, or Bill was there.
H*L H% H*L H% H*L L%
b. John was there, (or) Mary was there, or Bill was there.
L*H H% L*H H% H*L L%

c. John was there, (or) Mary was there, or Bill was there.
H*L % H*L % H*L L%

The predicted strangeness of (18a), as indicated by the question mark, is in line with my own judgments, but I am unaware of any empirical research that could corroborate or contradict this, so this short subsection will serve, even more so than previous sections, only to highlight an interesting prediction.

The predicted strangeness of (18a) stems from the fact that the low trailing tones indicate that each list item, i.e., each disjunct, is taken to comply with the maxims relative to some theme. Compliance with the maxims entails the clear communication of an intent that complies with I-Quality, and this is potentially problematic: if a speaker utters a disjunction she typically does not take each disjunct to be true, or she would have uttered a conjunction instead. A similar strangeness is predicted for plain falling boundaries. In sum:

10.8. Prediction. *Disjunctive* lists with prefinal fall-rising or falling boundaries are a bit strange (i.e., possible only in special circumstances, see below).

In what follows I will concentrate on the case with fall-rising boundaries, but similar considerations apply to the case with falling boundaries.

10

There are certain special circumstances in which the strangeness is predicted to dissolve. For instance, disjunctions can be used in a way that resembles conjunction, especially if the disjuncts contain existential modal verbs (e.g., Partee, Meulen, and Wall 1993, p.101; Zimmermann 2000; Aloni 2007; Ciardelli, Groenendijk, and Roelofsen 2009):

(19) You may have apple juice, or you may have orange juice.

If the speaker is assumed to be an authority, this disjunction is understood to imply that both disjuncts are true, i.e., you may have either one (though presumably not both) – this is commonly called the "free choice effect". The details of how the free choice effect may come about are inessential for current purposes; what matters is that fall-rise on the first disjunct in (19) is predicted to be fine in principle, because the disjunct on its own can clearly express an intent that complies with I-Quality: the speaker knows that the addressee may have apple juice.

Something like a modal can perhaps on some occasions be implicit, for instance if the disjuncts are *metalinguistic* (cf. Horn, 1985; Geurts, 1998). To me the fall-rising boundaries in (18a) seem to improve if I imagine it thus:

(20) Sue is so gullible... You can tell her anything!
John was there, or Mary was there, or Bill was there...
H*L H% H*L H% H*L H%
Anything, and she'll take your word for it.

Although a bit contrived, this would arguably be a case where even though the list is disjunctive, each disjunct on its own can contribute a compliant intent – namely that Sue will believe it if you say that X was there – hence fall-rise boundaries are predicted to be fine in principle. (Inessential for the current argument is that I changed the contour on the third disjunct into a fall-rise as well; this seemed to me to make the example more natural for reasons that I will not here try to identify.)

Furthermore, "or" may sometimes be understood as "because otherwise":

(21) John was there, or (else) he would have told me.

And again fall-rise on the first disjunct is predicted to be fine in principle. Basically, whenever "or" is used in a way that is essentially (at the level of intents or speaker beliefs) conjunctive rather than disjunctive, the disjuncts can in principle serve to convey their own compliant intents, and the strangeness to which prediction 10.8 refers is expected to dissolve.

5 Summary and discussion

This chapter presented the core predictions of the ICM theory with regard to various list intonations, and I hope to have shown that these predictions are plausible insofar as the empirical phenomena are clear. Summing up, the main predictions are:

1. list-internal rises can and sometimes must be blamed on literal unfinishedness, i.e., suspensions of I/A-Clarity and Content Efficacy (prediction 10.3);

2. the trailing tones of lists with level prefinal boundaries convey the same intents as in their boundary-less counterparts (prediction 10.4);

3. certain superficially quite different contours impose the same (non-)compliance constraints on an utterance, differing only in when/where (non-)compliance is marked (section 3.3);

4. list-internal falling boundaries imply that the list must be conceived of as a sequence of separate utterances (prediction 10.7);

5. disjunctive lists with prefinal falling or fall-rising boundaries are a bit strange (prediction 10.8).

I hope that these may also serve as plausible hypotheses for future empirical research.

For reasons of explicitness and clarity, this chapter also introduced a slight extension of the formalism based on dynamic logic, and in particular Dynamic Epistemic Logic. I took the main effect of an utterance to be the public observation

of its contents. Although the formal techniques (which I did not present in detail) are standard, my conception of the main effect of an utterance appears not to be very common. Most existing work on DEL rather takes what is publicly observed (or "publicly announced") to be the *intents* of an utterance – and not *what* they are, but that they are *true*. That is, existing work ignores the content/intent distinction and bypasses the maxims of Manner and Quality. This may be defensible if one's interest is in the dynamics of information exchange and not in the linguistic signals used.

Dynamic perspectives are also quite common in the more linguistic literature, primarily in work on the incremental construction of (representations of) discourse structure and in accounts of phenomena like anaphoric reference that seem to be sensitive to this (e.g., Kamp 1981; Heim 1982; Groenendijk and Stokhof 1991; Kempson, Meyer-Viol, and Gabbay 2000; see also chapter 6). Groenendijk and Stokhof show that we can and perhaps should conceive of semantic content itself as *dynamic* in the technical sense of encoding not a piece of information but some potential effect on a context. The dynamic approach taken in this chapter is intended to be compatible with these existing dynamic approaches. Moreover, a future, formalized theme-pragmatics may ultimately have to be dynamic as well, not only with regard to epistemic states but also at the level of goals and themes (see Ciardelli and Roelofsen 2015b for a relevant variant of DEL in which the *issues* that an agent entertains may be dynamically raised and resolved; cf. also the "discourse-centered" approaches discussed in chapter 2). Nevertheless, the reason for adopting a dynamic approach in the current chapter was somewhat different, and quite restricted, namely to allow formal reference to utterance parts, as required by the ICM theory.

Chapter 11

A unifying understanding of rise-fall-rise

> Bicycle Repairman?! But how!?
>
> (Monty Python's Flying Circus 1:3, 1969)

1 Introduction

The *rise-fall-rise* contour (L*HL H%; RFR) has been prominent in the literature for several decades. RFR has a number of rather clear, intuitively disparate uses. For instance, it can be used to convey uncertain relevance (1), to express surprise (2), to deny some aspect of a previous utterance followed by a correction (3), to indicate the "topic" of the utterance, such as Fred in (4), and to delineate material that is in some sense beside the main point (5):

(1) A: Have you ever been West of the Mississippi?
B: I've been to Missouri...
L*HL H%

(2) A: I'd like you here tomorrow morning at eleven.
B: Eleven in the morning?!
L*HL H%

(3) A: So I guess you like [æ]pricots then?
B: I don't like [æ]pricots – I like [ei]pricots!
L*HL H% H*L L%

(4) A: What about Fred, what did he eat?
B: Fred, ate the beans.
L*HL H% H*L L%

(5) B: John, who is a vegetarian, envies Fred.
L*H H% L*HL H% H*L L%

Example (1) is from Ward and Hirschberg 1985, (2) from Ward and Hirschberg 1986, (3) from Constant 2012, (4) from Jackendoff 1972, and (5) is in line with examples in Potts 2005. The main challenge posed by RFR is to find a common denominator for these various uses that is still sufficiently restrictive to yield some predictions of interest, for instance concerning differences between RFR and a plain rise, implications like exhaustivity and speaker commitment, and the fact that in some cases RFR seems to favor a particular scope interpretation. No existing account meets this challenge.

The aim of this chapter is to show that the ICM theory offers a promising account of RFR. At its core lies the following prediction, which I briefly mentioned already in chapter 10 (the importance of this prediction for an account of RFR was highlighted in Westera 2014b):

11.1. Prediction. An utterance with RFR must address at least two potentially distinct themes.

This prediction is derived from the ICM theory as follows. The high right boundary tone of RFR indicates a maxim suspension relative to the main theme, while the low trailing tone on the accent indicates epistemic compliance relative to some theme due to which the accented word was important. For instance, the following intents are predicted for (1B) above (the names p_3 and p_4 are chosen somewhat arbitrarily):

H%: $p_3 = {}^\wedge\neg\Box\,\textsc{Maxims}(\mathcal{T}_0)$
-L: $p_4 = {}^\wedge\Box\,\textsc{Maxims}(\mathcal{T}_1)$ (s.t. $\mathcal{T}_1$ makes "Missouri" important)

Since the same part of an utterance cannot both comply and not comply relative to the same theme, the main theme $\mathcal{T}_0$ must be at least potentially distinct from $\mathcal{T}_1$. In keeping with the potentially simplifying assumption that utterances have only a single main theme, I will assume that the additional theme involved in RFR, i.e., the theme that unlike the main theme is compliantly addressed, has lower precedence than the main theme, and I will accordingly call it the "side theme". In this chapter nothing essential will hinge on whether this generalization is correct.

For some uses of RFR, prediction 11.1 is immediately plausible. For instance, in (5) RFR occurs on a construction that seems to convey information that is not the main point, i.e., a *side intent*, which addresses a side theme. A similar understanding is available for the use of RFR on interjections:

(6) B: John – he's Mary's brother – envies Fred.
L*H H% L*HL H% H*L L%

Indeed, Gussenhoven (1984, p.211) paraphrases this use of RFR as "You with me so far? Now for the main point", and Wagner (2012, p.25) notes that RFR occurs on material that contributes Potts-style (2005) "conventional implicature",

or what Simons et al. (2010) call "non-at-issue content". I take this understanding of examples like (5) and (6) to extend to constructions that serve to clarify the pragmatic status of the utterance, as in (7) and (8):

(7) B: On an unrelated note, Fred is a vegetarian.
L*HL H% H*L L%

(8) B: As for Fred, he ate the beans.
L*HL H% H*L L%

Here the constructions marked by RFR can be understood as addressing side themes like "how does the utterance relate to the preceding discourse?", or "what is the utterance about?". Altogether, examples (5), (6), (7) and (8) are a mixed bunch, but what they have in common is that they are easily reconciled with prediction 11.1. For this reason I will set these examples aside.

I will concentrate, instead, on the uses of RFR illustrated by (1), (2), and (3), for which the adequacy of prediction 11.1 is less immediately clear (and I will also say a bit about (4)). That is, based on prediction 11.1, I will outline an account of the uncertain relevance, surprise and denial uses of RFR. I will argue that the side theme for the uncertain relevance use consists of goals evoked by the Strategy Principle, and for the surprise and denial uses of goals evoked by the Common Ground Maintenance Principle. As in the previous chapters, we will see that the ICM theory generates various ingredients of existing accounts from more basic assumptions – although it also does some things differently – and that the theory yields interesting new predictions.

Some remarks on phonetic/phonological variation Before presenting the account, I will discuss some phonetic and perhaps phonological (categorical) differences between the purported RFR contours in the foregoing examples.

For instance, Pierrehumbert and Steele (1987) find that the accent tends to be more delayed in the uncertain relevance use (1) than in the surprise use (2), in a way that suggests a categorical difference, namely between RFR (L*HL H%) for uncertain relevance and its non-delayed variant fall-rise (H*L H%, FR) for surprise. Pitch tracks for the two contours are clearly different, with the peak occurring later in (9a) than in (9b) (repeated from (9) in chapter 7):

(9) a. B: It's raining again...
L*HL H%

b. B: It's raining again?!
H*L H%

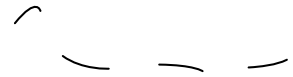
(As before, these pitch tracks are obtained from my own pronunciation.) In line with Pierrehumbert and Steele's results, Steedman (2014) associates the uncertain relevance use with RFR and the surprise use with FR. (Perhaps relatedly, Ward and Hirschberg (1985) seem to assume that RFR (which they call "fall-rise") marks the uncertain relevance use whereas FR (which they call "AC", following Bolinger) is used in lists, as a "continuation rise"; and Pierrehumbert and Hirschberg (1990) transcribe the RFR-like contour in (4) as a FR.)

Now, the ICM theory is silent about the contribution of the delay operation, and also in the current chapter I will remain agnostic – but for the sake of concreteness I will sketch one possible account. Let us tentatively assume that the delay indicates *extra significance* (Gussenhoven, 1984), of a sort that is adequate only if the proposition expressed is new to the conversation. In cases of uncertain relevance the proposition expressed is typically new and its relation to a preceding topic unclear, whereas the converse is true for the surprise use of RFR, because what one is surprised about is typically a preceding utterance (Ladd, 2008). It would follow that delayed RFR is fine and perhaps preferred in cases of uncertain relevance, but not in cases of surprise. This explanation seems to me plausible and parsimonious, but I will leave it as a mere suggestion; in the remainder of this chapter I will treat RFR and FR as interchangeable.

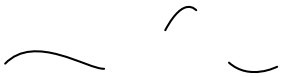
Another difference between the uncertain relevance and surprise uses is that the pitch excursions appear to be greater for the latter. For instance, Ward and Hirschberg (1992) presented participants with an utterance with RFR and found that a surprise interpretation was favored if the final rise of RFR was higher, and an uncertain relevance interpretation if it was lower. Within ToDI the height of a high boundary tone is a paralinguistic dimension, hence the greater pitch excursions in case of surprise could be blamed, following Banziger and Scherer 2005, on the higher emotional activation associated with being surprised, compared to the more reserved attitude that will generally accompany uncertain relevance. (Ward and Hirschberg's findings suggest also that paralinguistic cues can overcome whatever might make a delayed accent dispreferred for the surprise use, at least in interpretation experiments.)

Lastly, as Ladd (2008) notes, (R)FR must not be conflated with the "contradiction contour", henceforth "CC" (which may not be available in British English, e.g., Gussenhoven 1984). The two contours are treated as one in Liberman and Sag 1974, and more recently in Constant 2012. In contrast, Goodhue and Wagner (2016) treat the CC as phonologically very different from (R)FR; they transcribe the CC as H+L* H% (or ToBI's H+L* L-H%), i.e., as a low accent with *leading H* (H+) followed by a high final boundary tone. A pitch track of the CC is given in (10a). As Goodhue and Wagner note, following Ladd, the CC is quite different from a FR contour with the same accent placement, as in (10b):

(10) a. I don't like [æ]pricots...
H+L* H%



b. I don't like [æ]pricots...
H*L H%



c. I don't like [æ]pricots...
H*L H%

Liberman and Sag's and Constant's confusion of (R)FR and CC can be understood by looking at the variant in (10c), i.e., a FR contour where the accent occurs very early in the utterance: the pitch tracks of the CC in (10a) and FR in (10c) are very similar. However, pitch is only one dimension of intonation: the difference in accent placement between (10a) and (10c) gives rise to a greater intensity and lengthening of "apricots" in (10a), but of "I" in (10c). Thus, despite a superficial similarity to FR, the CC is simply a different contour, and in the remainder of this chapter I will set it aside.

Outline Section 2 presents an account of the uncertain relevance use of RFR, as illustrated by (1), in terms of the Strategy Principle. Section 3 presents an account of the surprise use (2) and the denial use (3) in terms of the Common Ground Maintenance Principle. Section 4 provides a detailed comparison to a broad range of existing accounts of RFR. Section 5 concludes.

2 Strategic side themes

I propose that the uncertain relevance use of RFR, as illustrated by (1), can be understood in terms of the Strategy Principle. This proposal is spelled out in two subsections. Section 2.1 outlines what strategies are, and how different types of strategies underly different types of uncertain relevance uses of RFR. Section 2.2 considers in more detail in which circumstances it is rational for a speaker to pursue a strategy, in particular given which clashes, from which a number of predictions can be derived.

2.1 Types of strategies

Recall from chapter 2 that a distinction can be drawn between presentational (or cosmetic) "strategies" and information-seeking strategies. The first type is governed by the Thematic Organization Principle, and consists in the reorganization of the goals of a prior theme into several new themes, such as the division of a symmetrical theme into a positive and a negative part (chapter 5). Information-seeking strategies consist not (only) in the reorganization of prior goals, but (primarily) in the addition of new goals, governed by the Strategy Principle, which has not really played a role in this dissertation thus far. I will henceforth, unless indicated otherwise, take "strategy" to mean an information-seeking strategy, and keep referring to the presentational/cosmetic kind by "thematic reorganization".

The Strategy Principle, defined in chapter 2, states that:

(i) a strategic goal g' for a certain goal g can be evoked if the speaker considers it unlikely that g can be directly achieved (by any of the interlocutors), but possible that it can ultimately be achieved;

(ii) strategic goals thus evoked are (other things being equal) of lower precedence than the original goals, and hence will be pursued as a side theme;

(iii) strategic goals must, with sufficient likelihood, be part of a strategy for g that is optimal with regard to, e.g., success likelihood, transparency, orderliness, and efficiency.

Chapter 2 did not yet explicate the notion of strategy. I intend the following definition to identify a minimal, essential feature of strategic behavior, not just in conversation but in planning and problem-solving more generally (e.g., Russell and Norvig 2003, ch.11):

11.2. Definition. **Strategy:**
A set of goals G is a *strategy* for a goal g (in a given context) if, and only if, achieving all of the goals in G entails (in the given context) achieving the original goal g.

This definition is not very restrictive. For instance, $\{g\}$ counts as a strategy for g. And if G is a strategy for g then so is any superset of G, even if it contains completely unrelated goals. This unrestrictiveness is curbed by item (iii) above, i.e., that strategies must be sufficiently likely to succeed in a transparent, orderly, efficient way.

It is unnecessary for a speaker to have planned an entire strategy before pursuing a strategic goal. Relatedly, for an addressee or linguist to make sense of an utterance bearing RFR, we need only understand which strategic goal is immediately being pursued and what ultimate goal this is a strategy for – anything in between will matter only once we look at subsequent utterances. For this reason

the following terminology will be convenient, given a strategy G, conceived of as a set of goals or, equivalently, the corresponding set of propositions that ought to be established:

- **start:** the first proposition(s) in G that are to be established;
- **end:** the proposition that G ultimately serves to establish, i.e., for which it is a strategy; this will typically be a goal from a prior theme;
- **link:** for any proposition in G that is a start, the link is the weakest proposition together with which the start entails the end.

The link is just the material implication from start s to end e, i.e., $\overline{s} \cup e$. Establishing the link need not itself be a goal in the strategy G – there may be reasons to rather try to establish something stronger, say, if that makes for a more natural, simpler contribution; and of course the link can also be established indirectly, by means of a strategy.

To illustrate, consider again (1), repeated here:

(1) A: Have you ever been West of the Mississippi?
B: I've been to Missouri...
L*HL H%

The end of B's strategy is the proposition that B has been West of the Mississippi, the start is the proposition that B has been to Missouri, and the link is that if B has been to Missouri, then she has been West of the Mississippi. By asserting that she has been to Missouri, speaker B immediately establishes the start; but she is uncertain about the truth of the link – otherwise she would have already known the truth of the end and there would have been no need for a strategy to begin with.

Let us assume that the Strategy Principle (in particular item (i) above) captures the only circumstance in which strategic goals may be evoked, hence that a speaker pursues a strategy only if she is unable to directly and with certainty establish the end goal. Let us assume, furthermore, that the initiator of a strategy normally knows what the starting goal of the strategy is. It follows that a speaker who pursues a strategy must be uncertain about at least one of the following (for otherwise she would not be uncertain about the truth of the end):

- **start-uncertain:** the truth of the start (and the end);
- **link-uncertain:** the truth of the link (and the end); or
- **end-uncertain:** the *nature* of the end (and, hence, of the link), i.e., which proposition it is;

Accordingly we can distinguish start-uncertain strategies, link-uncertain strategies, and end-uncertain strategies. Note that this categorization is not something that needs to be assumed – it simply follows from the notion of strategy of definition 11.2, and the fact that a speaker's epistemic state may relate differently to the various parts of a strategy.

To illustrate, the strategy in (1) is a purely link-uncertain strategy: B knows the nature and truth of the start (that she has been to Missouri), and the nature of the end (her having been West of the Mississippi), but not the truth of the link, basically, the geographical relation between Missouri and the Mississippi. An end-uncertain strategy occurs in several other examples reported in Ward and Hirschberg 1985, such as the following (their (58)):

(11) A: Are you a doctor?
B: I have a PhD...
L*HL H%

As Ward and Hirschberg note, B's uncertainty seems to pertain to whether A is asking about the academic degree or the medical profession. Since B knows, presumably, which degrees and professions she has, her uncertainty can pertain only to what exactly A is asking, hence her strategy is a purely end-uncertain one.

As far as assertions are concerned, strategic RFR can occur only in case of a link-uncertain or end-uncertain strategy. To see why, consider the following (constructed) variant of (1), where the strategy employed by B is instead of the start-uncertain type:

(12) A: Have you ever been West of the Mississippi?
B: a. I've been to Missouri? / b. Have I been to Missouri?
A: Yeah.
B: Okay, then I have been West of the Mississippi.

Here B knows the truth of the link (i.e., that being in Missouri entails being West of the Mississippi), and the nature of the end, but not the truth of the start: she asks whether she has been to Missouri, either by means of an I-Quality-suspending assertion (12a) or by means of a genuine (interrogative) question (12b). Since, by assumption, (12a) suspends I-Quality, it must be a rising declarative of the sort discussed in chapter 9 (and as such it is subject to the distributional restrictions identified there) – it cannot have RFR, because the low trailing tone would have falsely indicated compliance with I-Quality. Hence:

11.3. Prediction. Strategic RFR on an assertion involves a link-uncertain or end-uncertain strategy, not a start-uncertain strategy.

The same does not necessarily hold for the interrogative question in (12b). Assuming that the I-maxims simply do not apply to questions (see chapter 12), a

low trailing tone in (12b), or a low boundary tone for that matter, would not indicate compliance with I-Quality. Therefore, if RFR on questions is possible at all (Wagner (2012, p.26) claims it isn't), it is predicted to be compatible with a start-uncertain strategy – unlike the case of assertions. But in the remainder of this chapter I will set questions aside.

Relation to "strategies" in Roberts 2012/1996

Roberts (2012/1996) defined a notion of strategy that has been quite influential in the subsequent literature. Although I am unaware of an application of her notion to situations involving uncertain relevance, it seems to me that it could in principle be employed to that end (perhaps with some minor changes, such as replacing entailment relative to the context by entailment relative to an *expected* or *possible* future context). Here I will not explore the potential of Roberts's notion of strategy for an account of the uncertain relevance use of RFR, but compare her notion of strategy to the current notion only at a more general level.

Roberts defines a notion of strategy on sets of propositions, each conceived of as a "question", a notion that in her approach does double duty as something like themes and as something like the intents of utterances of interrogatives. In what follows I will use "question" and "theme" interchangeably. Following Roberts (2012, p.11/p.18):

- a question Q' is part of a *strategy* for a question Q if and only if any complete answer to Q' entails, together with contextual knowledge, at least a partial answer to Q; where:
- a proposition p is a *partial answer* to a question Q if and only if the truth of p entails, for *some* proposition $q \in Q$, its truth or falsity; and
- a proposition p is a *complete answer* to Q if and only if the truth of p entails, for *each* proposition $q \in Q$, its truth or falsity.

Given this definition, three features of Roberts's notion of strategy set it apart from mine:

(i) it is defined at the level of resolving questions/themes, not at the level of establishing individual propositions;

(ii) it is intrinsically "symmetrical", in the sense that we may as well, as far as her strategies are concerned, close all questions/themes under negation.

(iii) it does not permit strategic questions/themes whose complete answers *don't* contextually entail a partial answer to the original question/theme;

I will briefly discuss these features.

Item (i) reflects a primarily methodological choice. Nothing prevents us from doing (roughly) the same as Roberts, namely, defining a (derivative) notion of strategy at the level of themes. For the sake of concreteness, we may say, for instance:

- a theme T' is part of a strategy for another theme T if and only if T' consists (exclusively) of goals that are elements of a strategy for some goal in T.

Like Roberts, we may in principle impose additional requirements, e.g., that a strategic theme T' must be sufficiently demanding for its complete resolutions to entail a partial resolution of the prior theme T (item (iii)), or that strategic themes must be symmetrical (item (ii)) – though these may not be appropriate (see below). But it seems to me preferable to keep such requirements out of the notion of strategy, and to regard and motivate them, rather, as aspects of the Thematic Organization Principle. This is a more modular approach, which as such will likely result in a more transparent theory (provided, of course, the modularity can be maintained in light of the empirical data). Moreover, keeping such restrictions out of the notion of strategy retains the minimal and domain-independent notion of strategy captured by definition 11.2, which could facilitate future integration with a more general cognitive theory of goals and planning.

Items (ii) and (iii) are more substantive assumptions of Roberts's approach, but they do not seem to me particularly plausible. I will only briefly highlight why – it is unnecessary for present purposes to develop this into a proper argument. First, item (ii) blinds Roberts's notion of strategy to potential differences between positive and negative questions, which is likely inadequate in light of the discussion in chapter 5. Second, item (iii) seems to me unnecessarily strict: there is no reason why one could not strategically approach a complex question in increments that are smaller than partial answers (in the strict sense of Roberts) – what should matter is merely that completing the strategy *as a whole* will entail (at least) a partial answer. (Nevertheless, it may be difficult to show that item (iii) would be empirically inadequate, for if the relation between a strategic question Q'' and the question Q for which it appears to be a strategy violates item (iii), one can stipulate an intermediate, implicit question Q', such that Q'' is a strategy for Q', and Q' for Q, and these new strategy-relations could then each satisfy assumption (iii).) I believe that item (iii) is a consequence of the fact that Roberts conflates information-seeking strategies, for which it seems unnecessarily strict, with presentational "strategies", i.e., thematic reorganizations, of which item (iii) indeed necessarily holds.

2.2 Clashes that call for a strategy

Assumption 8.1 in chapter 8, which states that a rational speaker will knowingly violate or suspend a maxim only in case of a clash, invites us to investigate which clashes are to blame for the high right boundary tone (H%) of strategic RFR. To

that end, we must consider under which circumstances it is rational to pursue a strategy. As we will see, such considerations yield predictions with regard to (non-)exhaustivity implications of strategic RFR, and with regard to differences between RFR and plain rising declaratives.

The Strategy Principle states only when a strategic goal may be *evoked*; it does not state when (or even that) this newly evoked strategic goal should be actively *pursued*, i.e., included in some theme that is addressed. This will depend in part on the relative precedence of strategic goals compared to other goals that are evoked, for instance by the Pruning Principle. It will depend also on the Thematic Organization Principle, e.g., on considerations of orderliness and transparency. In particular, I assume that it is more orderly, and hence generally rational, to first directly accomplish as many goals of the theme as possible, before pursuing a strategy for the remaining goals. More precisely:

11.4. Assumption. Given a theme T, a rational speaker will normally address a strategic theme for T (i.e., a theme in which strategic goals for the goals of T are organized) if, and only if, for all goals g of T, the speaker considers it unlikely that g can be directly achieved (by any of the interlocutors).

This further explication of the Thematic Organization Principle would ideally be derived from more general considerations of orderliness, but in what follows I will just take it for granted.

Assumption 11.4 entails that, given a main theme, a strategic side theme is addressed only once no propositions are believed with certainty to be true and main-thematic, i.e., in case of an I-Relation/I-Quality clash relative to the main theme (see chapter 8) – and the speaker must consider it likely that the other interlocutors face a similar clash. Moreover, it must not be a *hopeless* I-Relation/I-Quality clash, lest pursuing a strategy would be pointless: if all thematic propositions are believed to be false, then no strategy to establish any such proposition can be considered sufficiently likely to succeed. Hence, the following is predicted:

11.5. Prediction. The H% of strategic RFR must normally be blamed on:

- a truth-uncertain and/or theme-uncertain I-Relation/I-Quality clash;

optionally with a simultaneous theme-uncertain A-Relation/A-Quality clash, I/A-Relation clash, I-Relation/I-Quantity clash; and/or A-Relation/A-Quantity clash (see chapter 8 and appendix D).

In contrast, in case of a hopeless I-Relation/I-Quality clash, one would rather address a theme evoked by the Pruning Principle.

Prediction 11.5 seems to be correct for practically all examples that Ward and Hirschberg (1985) take to involve uncertain relevance, including (1) and (11)

given earlier. In (1) speaker B is well aware of a main-thematic proposition – her having been West of the Mississippi – but she is uncertain about its truth: a truth-uncertain I-Relation/I-Quality clash. In (11) she is (presumably) well aware of her own degrees and professions, but she is unsure whether A's inquiry pertains to the academic degree or the medical profession: there is an I-Relation clash and an (improper) theme-uncertain I-Relation/I-Quality clash. For the sake of completeness, let us consider another example from Ward and Hirschberg 1985, where there is a *proper* theme-uncertain I-Quality/I-Relation clash:

(13) A: Have you read *Portnoy's complaint*?
B: I've read *Goodbye, Columbus*...
L*HL H%

Presumably, speaker B knows which books she did and did not read. In particular, she knows that she read *Goodbye, Columbus*, but she is unsure whether this information is thematic, say, whether A's inquiry perhaps pertains to books by Philip Roth in general (however, for this broad interpretation of the theme of A's question to be possible the question must end with a high boundary tone; see chapter 12).

The type of clash that is to blame for the high boundary tone of strategic RFR aligns with the type of strategy used: in case of a purely truth-uncertain I-Relation/I-Quality clash, as in (1), the strategy can only be link-uncertain; in case of a purely theme-uncertain I-Relation/I-Quality clash (proper or improper), as in (11) and (13), the strategy can only be end-uncertain.

Some remarks on (non-)exhaustivity

RFR tends to be strange on utterances that are in some sense maximally informative (e.g., Ward and Hirschberg 1985; Horn 2001; Constant 2012). To illustrate, consider the following example from Ward and Hirschberg (their (25)):

(14) A: Did you read (at least) the first chapter?
B: (?) I read the whole dissertation...
L*HL H%

As we will see in section 4, several authors have tried to explain this by assuming that RFR somehow conveys non-exhaustivity (e.g., Hara and Van Rooij, 2007; Tomioka, 2010; Constant, 2012; Wagner, 2012). Indeed, the current account predicts that, in the case of strategic RFR, the main theme must not be exhaustively resolved: some proposition in the main theme must be considered possible, or no strategy could succeed, but not known with certainty, or no strategy would have been necessary (yet), according to assumption 11.4.

As Wagner notes, contrary to the other aforementioned authors, the non-exhaustivity of RFR pertains only to what is in current terms the main theme; the side theme may well be completely resolved. In support of this, Wagner cites the following example from Ward and Hirschberg 1985:

(15) A: Do you take credit cards?
B: Visa and Mastercard...
(L*HL) L*HL H%

As Wagner notes, B's response seems to imply that she accepts no other types of credit cards, but that it is unclear whether this resolves the theme underlying A's request, say, whether B takes any credit cards that A possesses. In current terms, exhaustivity is implied relative to the strategic side theme of which credit cards B accepts, and something like non-exhaustivity is implied with regard to the main theme of whether B takes any credit cards that A possesses (or, phrased more intuitively, it is implied that the theme remains open for B).

I have already explained how non-exhaustivity is predicted relative to the main theme. To account for the exhaustivity implication relative to the strategic side theme, we must assume something like the following:

11.6. Assumption. A strategic side theme, in case of a link-uncertain or end-uncertain strategy, will generally contain all goals evoked by the Strategy Principle that the speaker can immediately accomplish.

This plausibly captures an aspect of the Thematic Organization Principle. If this assumption is correct, then the low trailing tone in (15) is predicted to convey (via A-Quantity) that any proposition other than B's accepting Visa and Mastercard must be either false, or not contained in the strategic side theme, where the latter implies, via the Strategy Principle, that it was deemed insufficiently likely to be of strategic use. Hence, an exhaustivity implication is predicted that B does not accept any other credit cards, except perhaps some obscure type of credit card that she considers highly unlikely to be in A's possession.

By way of summary, and for future reference:

11.7. Prediction. In case of strategic RFR, non-exhaustivity is implied relative to the main theme, while something like exhaustivity is implied relative to the strategic side theme, i.e., that nothing to which no attention is drawn is considered to be both true and sufficiently likely to be of strategic use.

I will briefly return to this in section 4, when discussing existing accounts of the (non-)exhaustivity implications of RFR.

Strategic RFR vs. I-Relation-suspending rising declaratives

Instead of pursuing a strategy, a speaker may also cope with an I-Relation/I-Quality clash simply by suspending one of the maxims involved. A truth-uncertain I-Relation/I-Quality clash can be coped with by suspending I-Quality, giving rise to a rising declarative of the sort discussed in detail in chapter 9. A theme-uncertain I-Relation/I-Quality clash can be coped with by suspending I-Relation,

giving rise to a rising declarative like (16a), about which I have not yet said much (repeated from (16) in chapter 7):

(16) *(A isn't sure if B wants to know about neighborliness or suitability for dating.)*

A: What do you think of your new neighbor?

B: a. He's attractive? / b. He's attractive...
H* H% L*HL H%

The possibility of coping with a theme-uncertain I-Relation/I-Quality clash by simply suspending I-Relation raises the issue of when a speaker would prefer this over pursuing a strategy, i.e., prefer (16a) over (16b).

The current approach gives the following partial answer to this question. Assumption 11.4 entails that speaker B in (16b) must consider it sufficiently unlikely that some goal of A's theme can be directly achieved – because only then is a strategy called for. In contrast, in (16a) speaker B may well consider it likely that her intent is thematic – indeed, perhaps she must consider it sufficiently likely, if, as seems plausible, every intent must be sufficiently likely to serve some purpose, i.e., to comply with I/A-Relation relative to some theme or other. Thus:

11.8. Prediction. An utterance with RFR, as part of an end-uncertain strategy, is typically more tentative, i.e., deemed less likely to be relevant, than a plain rising declarative that suspends I-Relation (other things being equal, e.g., paralinguistic cues).

More informally, the prediction is that (16a) can be paraphrased as "This is probably relevant: he's attractive.", whereas (16b) would convey "I'm not sure if this is relevant, but he's attractive.". Although this prediction is more detailed than observations and discussions in the literature, it seems to me plausible and testable.

2.3 Summary

Once the Strategy Principle is granted, say, once it is assumed that rational speakers can pursue strategies, with some further clarifications about when and why they would do so, the uncertain relevance use of RFR initially illustrated by (1) is easily understood as involving a strategic side theme. Such themes must be part of an end-uncertain strategy, and blamed on a theme-uncertain I-Relation/I-Quality clash, or part of a link-uncertain strategy, and blamed on a truth-uncertain I-Relation/I-Quality clash. Non-exhaustivity is predicted relative to the main theme and something like exhaustivity is predicted relative to the side theme. Other things being equal, utterances with strategic RFR are predicted to be more tentative, i.e., deemed less likely to be actually relevant, than plain rising declaratives that suspend I-Relation.

3 Common ground maintenance side themes

Let us now turn to the surprise use and the denial use of RFR, i.e., examples like (2) and (3) given at the start of this chapter (these examples will be repeated below). I will demonstrate that these can be understood as serving side themes aimed at common ground maintenance, i.e., acceptance and denial of information provided by a previous utterance.

This section consists of three subsections. Section 3.1 introduces the required mechanisms for acceptance and denial. Section 3.2 shows that the surprise use of RFR can be adequately treated as a case of acceptance. Section 3.3 concentrates on the denial use of RFR, with particular attention to the way in which RFR seems to influence the perceived scope of negation.

3.1 Acceptance and denial

The Common Ground Maintenance Principle states that any implication of an utterance to the effect that the speaker believes something ($\Box\varphi$) evokes as goals, for the other interlocutor(s), to either agree (i.e., to assert φ) or disagree ($\neg\varphi$). Such goals are arguably pursued by B in the following constructed example:

(17) A: Christine was at the party.
B: a. (Okay/yes,) Christine was there.
b. (No,) Christine wasn't there.

And the proposition that is accepted or denied need not be a prior intent; in principle any implied belief can be targeted, e.g.:

(18) A: Christine had to pick up her brother from the airport.
B: a. (Oh,) Christine has a brother!
b. (Wait a minute,) Christine doesn't have a brother.

To treat (17) and (18) uniformly, as cases of acceptance/denial, is not to say that there can be no interesting differences. For instance, the common ground maintenance goals of (17), unlike those in (18), happen to be identical to goals of the prior theme or goals evoked by the Pruning Principle, and this means that B's responses in (18) involve more of a theme shift than in (17). This is a difference that an account of the various markers, e.g., "no" vs. "wait a minute", will likely have to take into account (cf. Simons et al. 2010).

The Common Ground Maintenance Principle states also that the goals it evokes normally have non-maximal precedence (where precedence, recall from chapter 2, combines factors like importance and priority with something like centrality). The motivating idea was that common ground maintenance is primarily a conversation-internal affair, which serves conversation-external goals only indirectly by facilitating conversation. This bears on the FR contour as follows: since common ground maintenance goals have non-maximal precedence, such goals

can be addressed as side themes, thus predicting the following acceptance/denial use of FR:

(19) B: Was there anyone interesting at the party?
A: Christine was there.
B: a. (Oh/Okay/Yes,) Christine was there... {Who else? / Why?}
H*L H%
b. (No,) Christine wasn't there... {Mary was. / She was ill.}
H*L H%

(Using "Christine" rather than, say, "John", helps distinguish FR from the "contradiction contour", as discussed in section 1.) I assume that the parts of B's responses with FR in (19) are analogous to her responses in (17): they serve goals evoked by the Common Ground Maintenance Principle. The difference is that the high right boundary tones in (19) signal that something remains to be said, i.e., that the main theme is something different.

For a more complete understanding of the acceptance/denial use of FR illustrated by (19), we must understand the precise nature of the main theme and the side theme. For the sake of concreteness I will offer some remarks in this direction.

The range of possible main themes of acceptance/denial with FR appears quite unrestricted; typical main themes may be those addressed by the continuations given in (19). The continuations "Who else?" and "Mary was." address (whatever remains of) the prior main theme, which makes sense given the Continuity Principle; the continuations "Why?" and "She was ill." both address themes that call for further evidence or explanation. If, in contrast, the prior main theme is completely resolved and no further elaboration is required, then common ground maintenance itself is expected to be the main theme, predicting a plain falling contour in such cases. This could be the case in (17). (The same can happen, for instance, if for some reason the Thematic Organization Principle increased the precedence of common ground maintenance goals, say, for reasons of orderliness.)

As for the nature of the side theme in cases of acceptance/denial with FR, the Common Ground Maintenance Principle does not say much about this: it states which goals become available, but not how they should be organized into a theme. According to the Common Ground Maintenance Principle the precedence of goals it evokes depends on, among other things, the desirability of something becoming common ground. Given this, it seems reasonable to assume that the side theme of acceptance/denial with FR will generally contain all goals evoked by the Common Ground Maintenance Principle with precedence above a certain threshold, or at least all such goals that the speaker can in fact accomplish. If so, then the low trailing tone of FR predicts an exhaustivity-like implication: nothing else was implied to be believed for which the current speaker considers common ground maintenance to be at least as important. An implication of this sort seems to me

plausible, but the details, and hence the precise nature of the side theme, will not matter in what follows.

A final clarification before we zoom in on the surprise use of RFR (and afterwards on the denial use): as Goodhue and Wagner (2016) note (e.g., their examples (22) and (24)), denials need not be negative/negated, e.g.:

(20) A: I need to know who *wasn't* at the party.
B: Christine wasn't there.
H*L L%
C: Christine was there – {I saw her. / *Mary* wasn't.}
LH*L H%

Speaker B expresses an intent by means of a negative sentence, and C denies the truth of this intent by asserting its negation, which, given double negation elimination, can be expressed by a positive sentence. This shows that denial should be understood primarily in semantic/pragmatic terms, not syntactically.

3.2 Surprised acceptance

Let us now consider the surprise use of RFR, illustrated in section 1 by (2), repeated here:

(2) A: I'd like you here tomorrow morning at eleven.
B: Eleven in the morning?!
L*HL H%

The ICM theory commits us to an analysis of this example as a case of acceptance, i.e., as analogous to (19a) above. The reason is that the low trailing tone of RFR indicates that B takes the intent of her utterance to comply with I-Quality:

11.9. Prediction. RFR commits the speaker to the truth of the intent.

This prediction may well be accurate for (2), where the continuation "(Okay, but) why so late?!" seems to be perfectly fine. But the prediction may be counterintuitive for cases like (21), where surprise RFR seems to function more like denial than acceptance (example from Constant 2012):

(21) A: So, I guess you really loved the movie then, huh?
B: Loved it!? I hated it!
L*HL H% H*L L%

Indeed, Ward and Hirschberg (1986) try to account for the surprise use of RFR (or "incredulity") in terms of denial rather than acceptance.

Altogether, prediction 11.9 raises at least three questions:

(i) As a case of acceptance, what is the source of the surprise implication?

(ii) Why do some cases of what appears to be surprise RFR, like (21), seem more like cases of denial than acceptance?

(iii) Is prediction 11.9 accurate in light of a comparison between RFR and I-Quality-suspending rising declaratives? Such rising declaratives likewise have a surprise use (e.g., Gussenhoven, 1984; Pierrehumbert and Hirschberg, 1990; Gunlogson, 2003), but without committing the speaker to the truth of the intent.

In what follows I will offer partial answers to these questions in support of prediction 11.9, and hence in support of an account of the surprise use of RFR in terms of acceptance.

(i) The source of the surprise implication

Various factors may work together to favor a surprise interpretation, but I believe that, above all else, paralinguistic cues are to blame, such as raised eyebrows and greater pitch excursions (Bolinger, 1985; Ward and Hirschberg, 1992; Banziger and Scherer, 2005) – and in written text the punctuation "!?" presumably plays an important role. After all, example (19) given earlier featured an acceptance use of RFR without any connotation of surprise. And conversely, with the right cues even a plain falling contour can convey surprise, as for instance in the following example (from Al Jazeera's "Head to Head" 2012/1):

(22) A: I pay you the compliment of assuming that you don't [believe that Muhammad went to heaven on a winged horse].

B: No I do, I believe in miracles.

A: You believe that!? You believe that Muhammad went to heaven on
H*L L% H*L H*L H*L
a winged horse!?
H*L H*L L%

This is not to say that there is no difference between the surprise use of RFR and the surprise use of a plain fall. In particular, only the former indicates that the main theme, which in the case of surprise RFR may typically be an elaboration theme, is left unresolved. This plausibly predicts that the surprise use of a plain falling contour, unlike RFR, conveys something like "and don't even bother to explain", a condescending message that may indeed be present in (22).

Besides paralinguistic cues, perhaps explicit acceptance as such may somewhat contribute to a surprise implication. The reason is that, because acceptance can be implicit (e.g., Groenendijk and Roelofsen 2009), explicit acceptance may occur typically only if accepting the information was somehow non-trivial, and one reason for this could be that the information went against one's prior expectations.

To my understanding this idea underlies Steedman's (2014) account of the surprise use of FR. However, it cannot be the whole story, given the manner-of-factly kinds of acceptance in (17) and (19a).

(ii) Metalinguistic surprise as denial

As I mentioned, prediction 11.9 may seem counterintuitive, as it commits us to treating as a case of acceptance examples like (21), repeated here, that intuitively feel more like cases of denial:

(21) A: So, I guess you really loved the movie then, huh?
B: Loved it!? I hated it!
L*HL H% H*L L%

Clearly B is not accepting that she loved the movie; quite the contrary. But how do we reconcile this with prediction 11.9? The answer, to which the ICM theory commits us, is that example (21) must be *metalinguistic*, i.e., it must be paraphrasable by something like:

(23) B: "Loved it" you say?! I hated it!

After all, this paraphrase can be safely treated as a case of acceptance: what B is accepting is merely that A uttered "loved it", not that A's intent, when saying it, was true – the latter is explicitly denied by B's continuation.

A metalinguistic treatment of examples like (21) may seem ad hoc, but in this case it seems to have a welcome consequence. As Constant (2012) notes, replacing "loved it" in (21) by something with roughly the same meaning results in a strange dialogue:

(24) A: So, I guess you really loved the movie then, huh?
B: (?) {Enjoyed it?! / Didn't hate it?!} I hated it!
L*HL H% L*HL H% H*L L%

This strangeness can be explained if metalinguisticness requires or strongly prefers literal echoic responses: since B's response in (24) is not literally echoic, it would not be naturally construed as metalinguistic. But then, as a case of non-metalinguistic acceptance, B's response would commit her to having enjoyed the movie (in line with prediction 11.9), which is then contradicted by her continuation "I hated it!", thus explaining the strangeness. Indeed, the strangeness seems (to me) to disappear if we replace the continuation by something weaker, i.e., if we ensure that a non-metalinguistic reading is unproblematic:

(25) A: I really loved the movie!
B: You {enjoyed it?! / didn't hate it?!} I thought you hated comedy!
L*HL H% L*HL H% H*L L%

In this case prediction 11.9 does not necessitate a metalinguistic treatment, hence a non-literal response is fine. Altogether, the foregoing suggests that, contrary to what some authors seem to assume (e.g., Constant 2012; Lai 2012), the surprise use of RFR is not always metalinguistic – although sometimes it must be.

In the proposed account, note that the denial flavor of examples like (21) is predicted to be only indirectly related to the use of RFR. The RFR contour (together with the right paralinguistic cues) merely conveys surprised acceptance of, in metalinguistic cases, the fact that something was uttered. One reason for such surprise could be that the intent of the utterance is false, as in (21), but this is not the only possible reason. Other reasons for being surprised about an utterance could be that the intent is not false but, say, unclear, irrelevant or in some other way inappropriate. This predicted flexibility is borne out in the following examples (from Ward and Hirschberg 1986; I have added the parenthesized continuations to clarify the intended interpretation):

(26) B: Did you take out the garbage?
A: Sort of.
B: Sort of?! (What do you mean "sort of"?!)
L*HL H%

(27) A: I bet I know why Mary isn't dating John anymore. He's ugly.
B: He's ugly?! (That's inappropriate!)
L*HL H%

By treating these denial-like uses of RFR as metalinguistic acceptance, we automatically predict that the denial may target various aspects of a preceding utterance.

(iii) Surprise RFR vs. I-Quality-suspending rising declaratives

The third and last question raised by prediction 11.9 is how the surprise use of RFR, which is predicted to involve compliance with I-Quality, compares to the surprise use of rising declaratives that suspend I-Quality. Consider, for instance, the following basic example from chapter 9, but now uttered with, say, a higher rise and raised eyebrows (this use of rising declaratives is discussed, a.o., in Gussenhoven 1984; Pierrehumbert and Hirschberg 1990; Gunlogson 2003):

(28) *(B sees A enter the room with an umbrella – much to B's surprise.)*
B: It's raining?!
H* H%

The crucial prediction is that (28) does not commit B to the fact that it is raining, whereas an analogous utterance with RFR would (at least if not metalinguistic).

At a general level, the predicted difference between RFR and plain rises is in line with the informal characterization by Gussenhoven (1984, p.20) that although both contours may convey surprise, plain rising declaratives express a stronger

request for hearer information, compared to RFR. More concretely, a contrast like the following, indicated by the question mark, is predicted:

(29) A: The meeting starts tomorrow morning at eleven.

B: a. I'm not entirely sure about that... Right before lunch?!
H*L L% L*H H%

b. (?) I'm not entirely sure about that... Right before lunch?!
H*L L% L*HL H%

(Note that B's utterance is not a literal echo, in order to discourage a metalinguistic interpretation; note also that not being entirely sure is compatible with the bias expressed by rising declaratives.) Whereas (29a) is predicted to be fine, (29b) is predicted to be somewhat strange, or at least involve a change of mind, because B's explicit uncertainty is practically incompatible with the commitment expressed by RFR (according to prediction 11.9). This predicted contrast aligns with my own judgments, but of course a proper empirical assessment is necessary.

Some suggestive (albeit partial) evidence in favor of the predicted difference between surprise RFR and rising declaratives comes from a production experiment by Goodhue et al. (2016). Participants were presented with several scenarios, in most of which they were first instructed to "know for a fact" that a certain proposition was true, and then asked to express their "incredulity" regarding a hypothetical speaker's claim to the contrary. This resulted in predominantly plain rising contours, and virtually no RFR. This is what one would expect if only the plain rising contour is compatible with genuine disbelief rather than surprised acceptance. According to prediction 11.9, perhaps along with some auxiliary assumptions (e.g., that surprised speakers will convey acceptance if possible, and avoid metalinguisticness if possible), one should be able to obtain more RFR contours by redoing the experiment, replacing "know for a fact" by "consider very likely", replacing "incredulity" by "surprise", and perhaps adding that the hypothetical speaker to which they are asked to respond is trustworthy and competent. (Based on another experiment, Wagner, McClay, and Mak (2013) conclude that RFR *does* convey uncertainty about the truth of the intent, but what their experiment shows is merely that participants understand RFR to indicate that the speaker is not "confident" about the intent, which I think is so vague as to be compatible with prediction 11.9.)

In sum, the ICM theory, and prediction 11.9 in particular, commits us to an acceptance-based account of the surprise use of RFR. I have highlighted two potentially welcome consequences of this prediction, namely that it forces us to treat certain cases of surprise RFR as metalinguistic, and that there must be a difference between the surprise use of RFR and the surprise use of I-Quality-suspending rising declaratives. These predictions to some extent align with some of the literature, and seem to me plausible and testable, but a proper empirical assessment is left to future work.

3.3 Denial and the scope of negation

Section 3.1 introduced the mechanisms of acceptance and denial, and section 3.2 argued that the surprise use of RFR can be adequately treated as a case of acceptance, even certain denial-like cases. This final subsection covers genuine cases of denial, as illustrated in (3) from section 1, repeated here:

(3) A: So I guess you like [æ]pricots then?
B: I don't like [æ]pricots – I like [ei]pricots!
L*HL H% H*L L%

The denial use of RFR is comparatively straightforward: some prior contribution (any type of implied belief) is negated, with RFR indicating that something remains to be said about the main theme, which may typically be either the prior main theme or some elaboration theme.

In (3) the denied contribution happens to be metalinguistic, i.e., that the fruit should be pronounced "[æ]pricots", but this does not have any particular bearing on the present discussion (a non-metalinguistic example of denial RFR was given earlier, in (19)). For the sake of concreteness, B's denial in (3), which involves *metalinguistic negation*, can be paraphrased roughly as follows, according to Horn 1985 and Geurts 1998, respectively:

- Horn: "One would not say 'I like [æ]pricots'...";
- Geurts: "I don't like what one would call '[æ]pricots'...".

The difference lies in the scope of the quotation marks; I refer to Geurts 1998 for arguments in favor of his analysis. For present purposes we can remain agnostic about the nature of metalinguistic negation – the goals served by both paraphrases may in principle be evoked by the Common Ground Maintenance Principle.

With the denial use of RFR being comparatively straightforward, I will concentrate instead, in the remainder of this section, on a closely related empirical puzzle, namely that RFR may favor an *inverse scope* interpretation of utterances like the following (e.g., Jackendoff 1972; Ladd 1980; Constant 2012):

(30) B: All my friends didn't come... (favored: $\neg\forall x(Fx \rightarrow Cx)$)
L*HL H%

This contrasts with the analogous utterance with a simple falling contour, for which surface scope seems to be the more natural interpretation:

(31) B: All my friends didn't come. (favored: $\forall x(Fx \rightarrow \neg Cx)$)
H*L L%

The aforementioned authors, among others, try to explain the favored inverse scope reading of (30) in terms of some purported contribution of the RFR contour.

However, as noted by many, RFR does not strictly rule out a surface scope interpretation (e.g., Gussenhoven 1984; Ward and Hirschberg 1985; though Constant (2012) assumes otherwise). By constructing a particular context around (30), a surface scope interpretation can be obtained, e.g.:

(32) *(B knows that none of her friends came.)*
A: Hey B, how many of your friends didn't come?
B: Why do you ask? All my friends didn't come...
L*HL H%

(Gussenhoven (1984) presents a more natural example, but it is a different sentence, with multiple accents.) With some effort, similar surface-scope-favoring examples can be constructed for the surprise use and the denial use of RFR. Such examples show that RFR does not really force inverse scope – inverse scope just happens to be the first reasonable interpretation that comes to mind when an example like (30) is presented out of the blue (Kadmon and Roberts 1986; cf. Content Efficacy, chapter 4). In the remainder of this section I will explain why this is the case.

Let us presuppose that some syntactic, semantic or pragmatic mechanism exists whereby a sentence like (30) can convey an intent corresponding to either interpretation, i.e., surface scope and inverse scope. The remaining puzzle is why one of the two would be favored. Furthermore, let us assume, perhaps simplifyingly, that the interpretations that come to mind first, when presented with an utterance with RFR out of the blue, reside among the three main uses of RFR investigated in this chapter: uncertain relevance, surprise and denial. Of these, I assume that the surprise use is not really available for (30), because it lacks the required paralinguistic cues (e.g., "?!"). Thus, what we must explain is why the uncertain relevance use and the denial use of RFR, if these *are* available for (30), favor an inverse scope interpretation.

If we conceive, first, of (30) as a case of uncertain relevance, a surface scope interpretation is discouraged in the following way. When presented with (30) out of the blue, our only cue as to the nature of the main theme is accent placement (which provides no certainty, because accents may well be due to the side theme rather than the main theme). The accent placement in (30), on "all" and nowhere else, invites us to imagine one of the following two types of dialogues, (33a) for the surface scope interpretation and (33b) for the inverse scope interpretation:

(33) a. Surface scope:
A: How many/which of your friends didn't come?
B: All my friends didn't come... (intended: $\forall x(Fx \rightarrow \neg Cx)$)

b. Inverse scope:
A: Which quantity of your friends is such that not this many came?
B: All my friends didn't come... (intended: $\neg\forall x(Fx \rightarrow Cx)$)

The crucial difference is that in (33a) B completely resolves A's question, but not in (33b) – the latter leaves open the possibility that *some* of B's friends didn't come, either. In section 2 I already explained why strategic RFR is strange on complete answers: there is no need for a strategy in such cases (the example there was (14), "I read the whole dissertation..."). This explains why, if we conceive of (30) as a case of uncertain relevance, the inverse scope interpretation is favored. Unsurprisingly however, (33a) can be improved by strongly suggesting the presence of a different main theme for B – this is what happened in (32).

If instead we conceive of (30) as a case of denial, which seems to me the more natural interpretation of (30) out of the blue, then the fact that an inverse scope interpretation is favored may be explained in two ways, one more syntactic and the other more semantic/pragmatic – perhaps they reinforce each other. The more syntactic explanation is that, as seems safe to assume, the typical way of expressing a denial (but not the only way, see (20) given earlier) is to embed the proposition to be denied under a negation, thus giving rise to wide scope negation (this explanation presupposes that the scope mechanism is syntactic). The more semantic/pragmatic explanation is as follows. Since what is denied is semantically (but not necessarily syntactically) the negation of the denial, (30) would deny different things depending on the scope relation:

- inverse scope: $\neg\forall x(Fx \rightarrow Cx)$; denies $\forall x(Fx \rightarrow Cx)$;
- surface scope: $\forall x(Fx \rightarrow \neg Cx)$; denies $\neg\forall x(Fx \rightarrow \neg Cx)$, i.e., $\exists x(Fx \wedge Cx)$.

If we explicate what would be denied as a preceding discourse move, we get the following dialogues (the parenthesized continuations may help obtain the intended reading):

(34) a. Inverse scope denial:

A: All of your friends came, right?

B: All my friends didn't come... (Some of them did.)
L*HL H%

b. Surface scope denial:

A: Not *all* your friends didn't come, right?

B: All my friends didn't come... (They all stayed at home.)
L*HL H%

I assume that both of these dialogues are fine – note that (34b) is a case of denying a negative with a positive, analogous to (20) given earlier. To explain why conceiving of (30) as a case of denial favors inverse scope, we must explain why a situation like (34a) comes to mind more quickly than (34b). The maxim of Manner may provide the start of such an explanation: in (34b) speaker A uses a rather complex way of expression (i.e., "not all not" rather than "some"), which leaves something to be explained – hence a natural context for (34b) is harder

to imagine. Now, in principle speaker A in (34b) could have used semantically equivalent "some", but the resulting dialogue seems to me rather strange:

(35) Surface scope denial:

A: Some of your friends came, right?

B: (?) All my friends didn't come... (They all stayed at home.)
L*HL H%

The reason for this strangeness is, plausibly, that in case of denial (and perhaps more generally) one would normally use the same ways of expression as the preceding utterance, i.e., either simply add a negation to the uttered sentence, or remove a negation if the uttered sentence was negative. This would again be a matter of Manner. Since the inverse scope interpretation in (34a) does not run into these challenges, such an interpretation is easier to imagine out of the blue.

In sum, I have proposed that (30) lacks the required paralinguistic cues ("?!") for a surprise interpretation, that an uncertain relevance interpretation favors inverse scope because the surface scope interpretation would fully resolve the kind of theme suggested by the accent placement, and that a denial interpretation favors inverse scope because denials typically have wide scope negation, and/or because, regardless, the surface scope understanding would lead to somewhat strange dialogues. Lest this seem too weak as an explanation, let me stress (following Kadmon and Roberts 1986) that even if the inverse scope interpretation of (30) is only slightly favored, this may suffice for it to always be the first interpretation that comes to mind, and (thereby) the only interpretation that a hypothetical speaker of (30) could have rationally intended out of the blue. For this reason the proposed explanation, though tentative in certain respects, may well suffice.

3.4 Summary

Earlier, in section 2, I demonstrated how the uncertain relevance use of RFR, initially illustrated by (1), can be explained in terms of a side theme evoked by the Strategy Principle. In the current section I demonstrated that the surprise and denial uses of RFR, initially illustrated by (2) and (3), can be understood in terms of the Common Ground Maintenance Principle. More precisely, with regard to the surprise use I have explained how the ICM theory commits us to treating this as a case of acceptance, how the surprise implication arises, how metalinguistic surprised acceptance may serve as a kind of denial, and that the predicted difference between the surprise uses of RFR and plain rising declaratives may be accurate. With regard to the denial use I have offered an explanation for the effect that RFR seems to have on the scope of negation.

4 Comparison to existing work

I will compare the current approach to the following strands in the literature:

1. Ward and Hirschberg's accounts of the uncertain relevance use (1985) and the surprise use (1986);
2. accounts that center on the non-exhaustivity effects of RFR (Ladd, 1980; Hara and Van Rooij, 2007; Tomioka, 2010; Constant, 2012; Wagner, 2012);
3. accounts of "contrastive topic" that spell this out in terms of:
   (a) selection from the context (Brazil, 1975; Gussenhoven, 1984; Steedman, 2014); or
   (b) thematic reorganization (or "strategies"; Jackendoff 1972; Roberts 2012; Büring 2003).

To my awareness, these strands exhaust the range of existing approaches to RFR that are sufficiently precise for a comparison to be insightful.

4.1 Ward and Hirschberg 1985, 1986

Ward and Hirschberg 1985: uncertain relevance

Ward and Hirschberg characterize relevance in terms of *scales*. A scale is an ordered set of things, such as distances, numbers, ranks, or amounts of people. In terms of scales, Ward and Hirschberg propose that RFR may serve to convey the following three types of uncertain relevance (p.765):

I. uncertainty about whether it is appropriate to evoke a scale at all;

II. uncertainty about which scale to choose, given that some scale is appropriate;

III. given some scale, uncertainty about the choice of some value on that scale; more precisely (p.766): about the position of the chosen value on the scale.

Ward and Hirschberg illustrate these types, respectively, by means of the following examples (among others), which we encountered earlier:

(13) A: Have you read *Portnoy's complaint*?
B: I've read *Goodbye, Columbus...*
LH*L H%

(11) A: Are you a doctor?
B: I have a PhD...
L*HL H%

(1) A: Have you ever been West of the Mississippi?
B: I've been to Missouri...
LH*L H%

According to Ward and Hirschberg, in (13) speaker B is uncertain whether A is interested just in that one book or whether the scale of "books by Philip Roth" is appropriate (type I); in (11) she knows that some scale is appropriate, namely medical professions or academic degrees, but is unsure which (type II); in (1) she knows which scale is appropriate, say, geographical locations relative to the Mississippi, but is unsure to which value on that scale her response corresponds (type III).

I am unaware of any example of the uncertain relevance use that would be covered by Ward and Hirschberg's three types but not by my account in terms of strategies, or vice versa. But whereas Ward and Hirschberg distinguish three types of uncertain relevance in terms of scales, the ICM theory generates a categorization based on clashes: (13) involves a proper, purely theme-uncertain I-Relation/I-Quality clash, (11) involves an I-Relation clash, and (1) involves a proper, purely truth-uncertain I-Relation/I-Quality clash. Moreover, whereas both (13) and (11) involve an end-uncertain strategy, (1) involves a link-uncertain strategy. There are two reasons why my categorization is preferable to Ward and Hirschberg's.

First, from the current perspective Ward and Hirschberg's type I uncertain relevance is an empty category. In chapter 5 I explained that "Hirschberg scales" can be conceived of as (indirect) representations of themes. Since every utterance must address some theme, i.e., involve some scale, uncertainty about whether some (any) scale is appropriate at all cannot occur. Now, Ward and Hirschberg could try to defend their type I on grounds that a singleton set is not really a scale. But this would not follow from their formal definition – and if it had, it would have excluded singleton scales/themes also from their types II and III, which would have left such cases uncategorized (the current theory predicts that (11) and (1) may well involve singleton themes, namely if A's questions end with a low boundary tone; see chapter 12). Moreover, it seems to me that merely changing the cardinality of the theme (or of the attentional intent) does not change the essence of an example; e.g., (36) seems to be more similar to (13) than to (11):

(36) A: Have you read *Portnoy's complaint*, or *Goodbye, Columbus*? (H%)
B: I've read *Nemesis*...
LH*L H%

Ward and Hirschberg would, to my understanding, categorize (13) and (36) differently, namely as type I and type II, respectively. But according to my categorization (13) and (36) both involve a proper, purely theme-uncertain I-Relation/I-Quality clash – they could of course be further distinguished by the cardinality of A's attentional intent, but that seems inessential.

The second reason why my categorization is preferable to Ward and Hirschberg's is that their three types are just stipulated, motivated primarily by descriptive coverage, whereas my categorization derives from more basic, plausibly independently motivated assumptions. By way of summary: the ICM theory predicts that RFR must involve some sort of side theme, the Strategy Principle provides a candidate, and the circumstances in which a strategic side theme can be pursued are fixed by assumption 11.4, which plausibly derives from considerations of orderliness. This, combined with a basic notion of strategy, is what yields a categorization based on the type of clash (or on the type of strategy).

Ward and Hirschberg 1986: surprise ("incredulity")

Ward and Hirschberg (1986) amend their three types of uncertain relevance to account for the surprise use of RFR, or "incredulity", by proposing that RFR conveys three types of *lack of commitment* ($\neg\Box$), namely, a lack of commitment to the appropriateness of I. the invocation of a (any) scale, II. the particular scale invoked, or III. the choice of some value on that scale. The uncertain relevance use is supposed to arise when this lack of commitment is combined with a lack of commitment to the contrary ($\neg\Box\neg$). The incredulity use is supposed to arise when this lack of commitment is paired rather with a commitment to the contrary ($\Box\neg$), i.e., a belief in the *in*appropriateness of the utterance in one of these three respects.

Ward and Hirschberg illustrate the three types of incredulity RFR with examples (26), (27) and (2) given earlier, repeated here:

(26) B: Did you take out the garbage?
A: Sort of.
B: Sort of?!
L*HL H%

(27) A: I bet I know why Mary isn't dating John anymore. He's ugly.
B: He's ugly?!
L*HL H%

(2) A: I'd like you here tomorrow morning at eleven.
B: Eleven in the morning?!
L*HL H%

Example (26) would involve type I incredulity: B believes that no scale is appropriate when it comes to taking out the garbage, i.e., you either do it or you don't. Example (27) would involve type II incredulity: B believes that a scale of attractiveness is inappropriate, say, because it is impolite, or because it should not matter. Example (2) would involve type III incredulity: B believes that the value of eleven (on the scale of times in the morning) is inappropriate. (As with their three types of uncertain relevance discussed earlier, if we take scales to be

something like themes, their type I incredulity may be an empty category, and (26) may have to be reclassified as type II.)

Our accounts of (26) and (27) are quite similar, the main difference being that I derive from more basic assumptions what Ward and Hirschberg need to stipulate. I treated these examples, recall, as metalinguistic cases of acceptance, where indicating surprise about something's being uttered can indirectly serve as a denial of some aspect of the utterance, e.g., its truth or appropriateness. But example (2) permits a non-metalinguistic understanding, and in that case our accounts differ: my account predicts that (2) can be a case of acceptance, whereas Ward and Hirschberg's treatment in terms of type III incredulity amounts to treating it as a case of denial. I have already explained why the current treatment, in terms of acceptance, may be adequate: it seems to force a metalinguistic treatment in the right circumstances, and certain predicted differences between RFR and a plain rise are partially supported by some experimental results – but more research is needed there. Moreover, the felicity (I assume) of the following example may resist treatment as a case of denial:

(37) B: Eleven in the morning?! Okay... That's much later than I expected!
L*HL H%

To maintain Ward and Hirschberg's denial-based account in light of this example, one would have to argue that B is either insincere, say, feigning disagreement for rhetorical reasons, or changing her mind in the middle, neither of which seems to me necessary here.

A more general shortcoming of Ward and Hirschberg's approach is the following. They intend their (1986) proposal to be a minimal refinement of their (1985) account of uncertain relevance, obtained by replacing "uncertainty" by "lack of commitment" (which then covers both uncertainty and commitment to the contrary). But in fact their amendment is more substantial, in particular when it comes to type III uncertain relevance. According to their (1985) account, type III uncertain relevance involves uncertainty about the choice of some value on the scale, or, more precisely (p.766), about the position of the chosen value on the scale. In contrast, according to their (1986) proposal it involves uncertainty about *the appropriateness of* the choice of some value on the scale. Although presumably uncertain relevance entails uncertain appropriateness (in some sense), the reverse does not hold: an utterance can be inappropriate in ways other than being irrelevant. This means that their (1986) formulation is substantially weaker than their (1985) account, more so than they themselves admit – and they do not explain how one might nevertheless derive an uncertain relevance implication in the relevant examples.

Indeed, at least given a certain intuitive interpretation of "appropriateness" (Ward and Hirschberg do not explicate this notion), their (1986) proposal may amount to treating RFR essentially in the way the ICM theory treats a plain rise:

as signaling that the speaker does not believe that the utterance complies with the maxims, i.e., either believes that it does not or is uncertain whether it does. As such, their account of RFR in general (though not of the surprise use specifically) may be compatible with the current account of RFR, but it predicts less – just as the ICM theory would have predicted less if we had ignored the low trailing tone of RFR. Foremost, their account lacks the common denominator that ICM predicts for RFR, i.e., prediction 11.1, that RFR involves a compliantly addressed side theme.

4.2 Accounts centered on non-exhaustivity

Several accounts of the contribution of RFR center on its strangeness on complete answers, as illustrated earlier by (14), repeated here:

(14) A: Did you read (at least) the first chapter?
B: (?) I read the whole dissertation...
L*HL H%

Ladd (1980, p.153) proposes that RFR indicates "focus within a given set", and accounts for the strangeness of (14) (or analogous examples) by noting that B's response in some sense covers the entire set, say, of dissertation chapters, rather than singling out one or some proper subset of them. Although Ladd's proposal is informal, several more recent accounts aim to formalize what I understand is the same basic idea, or at least a consequence of it, namely that RFR conveys *non-exhaustivity*. I will discuss four closely related approaches, namely Hara and Van Rooij 2007, Tomioka 2010, Constant 2012 and Wagner 2012. (Except Constant's account these are framed in terms of the notion of "contrastive topic", which I will discuss separately further below.) The contribution of RFR, according to these four accounts, can be paraphrased as follows:

- Hara and Van Rooij 2007: some proposition, contained in the theme due to which the RFR-accented word was important, is not believed to be true;
- Tomioka 2010: the utterance should not be interpreted exhaustively with regard to the theme due to which the RFR-accented word was important;
- Constant 2012: every proposition, contained in the theme due to which the RFR-accented word was important, that is neither entailed nor excluded by the intents of the utterance (including indirect intents), is not believed to be true – and there exists such a proposition;
- Wagner 2012: some salient proposition (not constrained by accent placement) that is not entailed by the intent, is not believed to be false.

I will discuss each in turn.

Hara and Van Rooij 2007 Hara and Van Rooij's account falls short of accounting for any non-exhaustivity conveyed by RFR: that a proposition is not believed to be true ($\neg\Box\varphi$) is compatible with it being taken to be false ($\Box\neg\varphi$), which is what exhaustivity through A-Quantity amounts to. Indeed, the contribution of RFR according to Hara and Van Rooij is just the sort of implication that is normally derived through I-Quantity.

Tomioka 2010 Tomioka's approach appears to be the most direct: RFR would simply block an exhaustive interpretation. He proposes to derive additional effects of RFR pragmatically, say, that the non-excluded propositions must be considered possible, by reasoning about why a speaker would not wish for her utterance to be interpreted exhaustively (just like in the current approach additional effects follow from reasoning about when a speaker could rationally pursue a strategy). This may be feasible, but since his proposal is not embedded within a reasonably general pragmatic theory it is difficult to evaluate.

A more substantial problem for Tomioka's approach, at least from the current perspective, is that it falls short of accounting for the non-exhaustivity of RFR. Tomioka assumes that exhaustivity is normally obtained by means of a grammatical exhaustivity operator, and that a constituent marked by RFR somehow escapes its scope, hence the non-exhaustivity. However, I hope to have made plausible that exhaustivity implications can be derived pragmatically on the basis of a non-exhaustive semantic content (and direct intent) – this was the main point of chapter 3. Hence, rendering the semantic content non-exhaustive, as Tomioka proposes RFR accomplishes, does not suffice to ensure that no exhaustivity implication will be delivered by the pragmatics after all.

Constant 2012 Constant's approach is similar to Hara and Van Rooij's in that there must be some proposition that the speaker does not take to be true. The difference is that according to Constant this should hold for *all* propositions of a certain sort, namely those that are neither entailed nor excluded by the utterance's intents (including implicatures). Still, as in Hara and Van Rooij's approach, this is basically an I-Quantity implication, hence it is not what prevents exhaustivity. Rather, Constant prevents exhaustivity by requiring in addition that the relevant set of propositions (i.e., that are neither entailed nor excluded by the utterance's intents) is non-empty. Crucially, an exhaustivity implicature would (at least in the simple, non-disjunctive cases with which Constant is concerned) exclude all propositions that are not entailed by the direct intent, and this would make the relevant set of propositions empty, contradicting the contribution of RFR. According to Constant, this contradiction is to be avoided by assuming that there is no exhaustivity implicature (as opposed to dropping the other side of the contradiction; Constant does not explain why). This would explain why RFR is strange on semantically exhaustive answers like (14) – and Constant uses

this to explain also why RFR favors an inverse scope interpretation of sentences like (30), "All my friends didn't come...", roughly in line with the first half of the explanation I proposed in section 3.3.

Although in this way Constant's account predicts non-exhaustivity, it does so relative to the wrong theme. Like Hara and Van Rooij and Tomioka, Constant assumes that the non-exhaustivity of RFR pertains to a theme due to which the accented word was important (i.e., a set of salient "focus alternatives", as discussed in chapter 7), which according to my account is the strategic side theme. As I noted in section 2.2, Wagner argues that the non-exhaustivity of RFR is not tied to accent placement in this way. Indeed, in contrast to the aforementioned accounts, my account predicts that RFR conveys non-exhaustivity relative to the main theme, and something like exhaustivity relative to the side theme (prediction 11.7).

Wagner 2012 Wagner assumes that some salient proposition, not necessarily constrained by accent placement, should be considered possibly true. Unlike Hara and Van Rooij's (and Constant's) assumption that RFR would indicate possible falsehood, Wagner's assumption that it indicates possible truth directly blocks exhaustivity, and it predicts that RFR on semantically exhaustive answers is strange. (Hara and Van Rooij argue against an account in terms of possible truth, on the basis that RFR can occur on "contrastive topics" even on the final list item of an exhaustive list. However, Wagner shows that this is the case only if RFR occurs somewhere within the final list item, not at the end. I will return to Wagner's observation further below.)

In section 2.2 I explained that for strategic RFR the current approach predicts both implications, i.e., possible falsehood and possible truth – since otherwise no strategy would be both necessary and feasible. Conversely, none of the aforementioned accounts explains how their purported contributions of RFR may give rise to an implication like uncertain relevance. Indeed, it seems to me that the mere existence of some salient proposition that is possibly true and/or possibly false may not be sufficiently restrictive for a more detailed account of the various uses of RFR, say, one that yields predictions of the sort presented in the preceding sections. It would require a detailed and reasonably general pragmatic theory, which none of these authors presents.

4.3 Relation to "contrastive topic"

Several strands in the literature assume that the (R)FR contour serves to mark the material on which it occurs as the "(contrastive) topic" of the utterance, in contrast to plain falling contours which would mark the "focus". For instance, the following examples would differ only in which constituent is the topic and which is the focus (from Jackendoff 1972; example (39) is identical to (4) from section 1):

(38) A: What about the beans, who had those?
B: Fred ate the beans...
H*L H*L H%

(39) A: What about Fred, what did he eat?
B: Fred, ate the beans.
H*L H% H*L L%

In (38) "Fred" would be the focus and "(the) beans" the topic, and the other way around in (39).

Several authors dispute that a straightforward mapping would exist between, on the one hand, types of contours such as RFR vs. plain falls, and, on the other hand, information-structural categories such as topic vs. focus (e.g., Hedberg and Sosa, 2008; Calhoun, 2007; Wagner, 2012). For instance, Wagner (2012) notes that the contours in (39) and (38) are not as symmetrical as many following Jackendoff take them to be. This is illustrated by the following contrast (Wagner's (44) and (45)):

(40) A: Did John insult Mary?
B: (?) No! Mary insulted John...
H*L H*L H%

(41) A: Did John insult Mary?
B: No! Mary, insulted John.
H*L H% H*L L%

This contrast is corroborated by experimental results reported in Meyer, Fedorenko, and Gibson 2011. The reason why (40) is somewhat strange, according to Wagner, is that utterance-final (R)FR indicates that some theme is left unresolved, and this does not seem to be the case in the context at hand. I refer to Wagner 2012 for additional arguments against the purported symmetry of (38) and (39).

Promisingly, the current approach predicts that (38) and (39) are not symmetrical. After all, (39) but not (38) must in the end address the main theme compliantly – in line with Wagner's observation. Moreover, whereas the low trailing tones in (38) both indicate compliance relative to a side theme for the utterance as a whole, the low trailing tone of the (R)FR contour in (39) instead indicates that the word "Fred" on its own must serve to compliantly address some side theme. Now, since in the given context the name "Fred" on its own cannot really convey anything except that the utterance will be about Fred, the current account plausibly predicts that "Fred" in (39) but not in (38) serves to indicate the "topic" of the utterance, in some sense. Put differently, (39) is plausibly predicted to be roughly on a par with the following more explicit variant, repeated from section 1:

(8) B: As for Fred, he ate the beans.
L*HL H% H*L L%

This example explicates what (39) plausibly conveys by means of impliciture. Of course a more detailed account of (39) would require a more precise maxim of Manner, and a theory of when topics are worth indicating. This falls outside the intended scope of this chapter. What matters for now is that the ICM theory predicts the right sort of asymmetry between (38) and (39), where (38) can be treated simply as a case of uncertain relevance.

The observed and predicted asymmetry between (38) and (39) notwithstanding, it will be insightful to relate the current theory to two common topic-based accounts of RFR:

- topics are given by/selected from the context (e.g., Brazil 1975; Gussenhoven 1984; Steedman 2014);
- topics serve as keys in a thematic reorganization (e.g., Jackendoff 1972; Roberts 2012; Büring 2003).

I will discuss each in turn. A third strand of approaches to topichood centers on non-exhaustivity, like Hara and Van Rooij 2007, Tomioka 2010 and Wagner 2012, but these have already been discussed.

Accounts based on givenness/selection It seems reasonable to assume that a typical circumstance in which it is rational to indicate the topic of one's utterance (in some intuitive sense) is if it is one of several potential topics that were available in the context. I take this to explain why many authors have associated topichood and/or RFR with something's being selected from the context rather than introduced anew (e.g., Brazil 1975; Gussenhoven 1984; Steedman 2014).

We can also understand why something like selection from the context may seem like a suitable common denominator for RFR more generally, i.e., not just cases of (plausibly) genuine topic marking like (39), but also for cases of acceptance and denial – for what is accepted/denied must be present in the context – as well as certain cases of uncertain relevance. Since something's being already known would be reason for it to not be worth sharing, uncertainty about what is already known may cause uncertainty about what is thematic, and hence strategic RFR may occur on utterances that express an intent that is potentially already known. Indeed, Gussenhoven (1984, p.205) notes that RFR can be used in this way in (42):

(42) A: Where shall we take aunt Annie for lunch?
B: Howard Johnson's...
L*HL H%

According to Gussenhoven, RFR can signal that B expected A to already know the answer, say, if Howard Johnson's is the only restaurant in town, or if A already asked the question before and was given the same answer.

The foregoing may explain why some authors consider something like selection from the context to be a suitable common denominator of all uses of RFR. But

the generalization is not ultimately tenable, e.g., Hedberg and Sosa (2008) note that RFR may also occur on genuinely new material. Indeed, it seems to me that, for instance, the information in (1) that B has been to Missouri may well be entirely new to the conversation, and be presented as such.

Accounts based on thematic reorganization It seems reasonable to assume that a typical type of context in which multiple potential topics are available, hence in which we may expect topic marking by means of RFR, could be one where a prior theme has just been divided into several new themes (i.e., thematic reorganization), such as in (39), where the theme of who ate what is supposedly addressed *by individual*. I take this to explain why several authors have sought to characterize topichood and/or RFR in terms of such thematic reorganizations (Jackendoff, 1972; Roberts, 2012; Büring, 2003). Now, Wagner (2012, p.23 onwards) argues in detail that these accounts are inadequate for cases like (38), which indeed the current approach predicts does not involve topic marking. But as far as actual topic marking is concerned, as arguably in (39), the adequacy of these accounts depends on whether thematic reorganizations are the *only* circumstance in which topic marking is appropriate, or merely a typical one. The latter seems to me more plausible, but I will leave this as a research question for future work.

Recall that thematic reorganizations (as a cosmetic type of "strategy") have been conflated in the literature with information-seeking strategies of the sort involved in the uncertain relevance use of RFR. This may explain why some authors have deemed a notion of "strategy" to be a suitable common denominator for the strategic use of RFR exemplified by (38) and the topic-marking use in (39). Nevertheless, according to the current account the two examples involve different types of strategies, which relate to the main contribution of RFR in very different ways. By way of summary: in (38) RFR indicates that a side theme is addressed and that the main theme is not compliantly addressed, and one way to make sense of this is in terms of a strategic side theme; in (39) RFR indicates that "Fred" conveys an intent, which can plausibly only be the proposition that the utterance is about Fred, and a typical circumstance in which this is worth sharing is when a prior theme was divided, by individual, into several new themes.

In sum, the current account correctly predicts that (39) and (38) are not symmetrical, while at the same time predicting, at least in outline, what these different uses of RFR have been perceived to have in common.

5 Summary and outlook

I hope to have shown that the ICM theory offers a promising account of RFR. It is based on the core prediction that utterances with RFR must address a side theme, and relies on theme-pragmatics to narrow down the range of possible side themes.

I have shown that three core uses of RFR – uncertain relevance, surprise and denial – can be understood in terms of the Strategy Principle and the Common Ground Maintenance Principle. For several other uses (e.g., non-restrictive relative clauses, interjections, and topics) I have offered more tentative suggestions as to how they may be accounted for. As in previous chapters, I have shown how various ingredients of existing accounts can be derived from more basic assumptions.

Although I have made certain core notions, like the notion of strategy, reasonably precise, the proposal has remained somewhat programmatic, and will inevitably remain so until a formal theme-pragmatics is plugged in. Nevertheless, some detailed predictions could already be derived that seemed to me both plausible and testable, for instance with regard to exhaustivity, metalinguisticness and commitment. As such, the current theory may serve both as a window on theme-pragmatics and as a starting point for proper empirical evaluation of the ICM theory.

Lastly, the general approach taken in this chapter is expected to be applicable to intonation contours with multiple accents and mixed trailing tones, a topic which I have mostly set aside in this dissertation for reasons of scope. With regard to such contours, like RFR, a core prediction is that there must be multiple themes.

Chapter 12

An account of question intonation

1 Introduction

This chapter presents an ICM-based account of intonation on questions, i.e., utterances of interrogative sentences, a topic that has received considerable attention in the recent formal literature (e.g., Han and Romero, 2004b; Roelofsen and Van Gool, 2010; Biezma and Rawlins, 2012). Although the account applies to questions in general, I will concentrate on the following sentential questions, with the given intonation contours:

(1) **Rising/falling simple questions:**

a. A: Was John at the party?
L*H H%

b. A: Was John at the party?
H*L L%

(2) **Rising/falling disjunctive questions:**

a. A: Was John at the party, or Mary?
L*H H% L*H H%

b. A: Was John at the party, or Mary?
L*H H% H*L L%

I will refer to the questions in (1) and (2) by means of the labels given in boldface. As far as intonation goes these labels transparently reflect only the utterance-final contours. The labels can of course be expanded so as to reflect also the prefinal contours, but this will not be necessary for current purposes: the intended contours will be as in (1) and (2) unless stated otherwise. I avoid the more common labels "alternative question" and "polar question" or "yes/no-question" for reasons to be given further below.

According to the ICM theory, boundary tones and trailing tones indicate (non-)compliance only with the *applicable* maxims (chapter 7). The core of the

present chapter is the assumption that the I-maxims do not apply to questions, i.e., that questions *opt out* of the I-maxims, in the sense of Grice 1989 (ch.2):

12.1. Assumption. **Questions and opting out:**
Questions (as utterances of interrogative sentences) not only lack a main informational intent, they also *opt out* of the I-maxims, i.e., the I-maxims do not apply, as far as the main theme goes.

This comes on top of assumption 6.7 in chapter 6, that questions lack a main informational intent. Assumption 12.1 explains why questions, which lack an informational intent and hence strictly speaking violate the I-maxims, may nevertheless have falling intonation, like (1b) and (2b): since the I-maxims do not apply to these utterances, intonational compliance marking cares only about the remaining maxims. More generally, given assumption 12.1, the ICM theory generates the following core prediction:

12.2. Prediction. In questions, boundary tones indicate (non-)compliance only with Manner and the A-maxims, not the I-maxims. The same holds for trailing tones in questions, but only if these serve to indicate (non-)compliance relative to the main theme.

The derivation of this prediction will be made more precise below, by means of a simple formalization of opting out.

On the basis of prediction 12.2, this chapter will account for three implications that the falling questions (1b) and (2b) have but which the rising questions (1a) and (2a) either lack or imply the negation of (e.g., Bartels, 1999; Roelofsen and Van Gool, 2010; Biezma and Rawlins, 2012):

(i) **thematic exhaustivity:** the speaker believes that only states of affairs in the attentional intent are thematic;

(ii) **exclusivity:** the speaker believes that at most one state of affairs in the attentional intent (plus those which it entails) is the case;

(iii) **sufficiency:** the speaker believes that at least one state of affairs in the attentional intent is actually the case (less robust for simple questions).

These will be illustrated further below. I will show that the ICM-based account of these implications derives from more basic assumptions several of the core ingredients of existing accounts, primarily Groenendijk and Roelofsen 2009 and Biezma and Rawlins 2012, although it also does some things differently, and yields some new predictions about the possible absence of exclusivity or sufficiency implications in certain circumstances. I will try to establish the plausibility of these new predictions, but a proper empirical assessment will be left to future work.

The formulation of the three implications is not theory-neutral, primarily because it presupposes the following attentional intents:

12.3. Assumption. The main attentional intents are:

$\mathcal{A}_0 = \{^\wedge Pj\}$ for questions (1a,b);
$\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm\}$ for questions (2a,b).

These are in line with my tentative derivation of the attentional intents of questions in chapter 6. They are also in line with the more semantic notion of "highlighting" (Roelofsen and Van Gool, 2010), and with what Biezma and Rawlins (2012) argue are simply the main semantic contents of interrogatives (in line with, e.g., Roberts 2012; Uegaki 2015; but contrary to, e.g., Han and Romero 2004b; Groenendijk and Roelofsen 2009). Where possible I will remain neutral with regard to the semantics of interrogatives, and when discussing existing accounts I will mostly ignore differences in semantic assumptions.

Although I will concentrate on the intonation contours given above, the main predictions to be discussed will also apply to the following variants:

(3) a. A: Was John at the party?
H* H%

b. A: Was John at the party, or Mary?
H*L (%) (!)H*L L%

These contours may be more typical than their counterparts in (1a) and (2b). The contour in (3a) is sometimes called the "question rise". With regard to (3b), I believe that some authors perceive and describe it as having a rise on the first disjunct and a fall on the second, i.e., they may not distinguish it from (2b). As I explained for declarative lists in chapter 10, the two variants impose the same compliance conditions on the utterance; the main predicted difference is that (2b) is more emphatic than (3b) about the fact that John's presence is not the only thing that matters. This difference will play a minor role further below.

Outline Section 2 introduces the three main phenomena in more detail. Section 3 presents the ICM-based account of the questions in (1) and (2), starting with a short subsection in which "opting out" of the I-maxims is formalized, for the sake of clarity and explicitness. Section 4 compares the account to existing approaches, in particular Groenendijk and Roelofsen 2009 and Biezma and Rawlins 2012. Section 5 concludes.

2 The main phenomena

2.1 Thematic exhaustivity

The thematic exhaustivity implication of falling simple questions, and its absence for rising simple questions, is apparent from the following contrast:

(4) a. A: Was John at the party?
L*H H%

B: Mary was.
H*L L%

b. A: Was John at the party?
H*L L%

B: (?) Mary was.
H*L L%

In (4a) B's response is fine, as Biezma and Rawlins note for an isomorphic example (their (62)). They say that a rising simple question "leaves open what other [relevant] alternatives might be salient" (p.400). In (4b) B's response is less smooth, according to Bartels (p.140), who notes that falling simple questions but not rising simple questions convey what Bolinger (1978b) describes as "the rigid prescription of a yes-or-no answer". (The response in (4b) may improve if we imagine B nodding or shaking her head, thereby resolving A's question, in which case the rest of her response can be understood as addressing a new theme evoked by resolving the prior one; cf. (5) in chapter 4.)

An analogous contrast is observed for disjunctive questions (isomorphic to Biezma and Rawlins's (4)):

(5) a. A: Was John at the party, or Mary?
L*H H% L*H H%

B: Bill was there.

b. A: Was John at the party, or Mary?
L*H H% H*L L%

B: (?) Bill was there.

In (5a) B's response is fine because A's intonation leaves open the possibility that Bill's presence is thematic; unlike in (5b) where A intonationally indicates that nothing except John's presence and Mary's presence is thematic.

In current terms: falling questions seem to imply that the states of affairs in the attentional intent exhaust the main theme, i.e., that nothing else is main-thematic. Formally, I take this implication to be the following (although if thematic competence holds the modal box can be stripped off):

$$\Box(\mathcal{T}_0 \subseteq \mathcal{A}_0)$$

Rising questions imply the negation of this, i.e., that something else is or at least may be main-thematic. This is the first of the three implications (i)–(iii) given earlier, that falling questions have but rising questions don't:

(i) **thematic exhaustivity:** the speaker believes that only states of affairs in the attentional intent are thematic;

The label "thematic exhaustivity" reflects that propositions are merely implied to be athematic, not false, unlike the more ordinary type of exhaustivity discussed in part I. Indeed, because falling questions do not appear to imply exhaustivity of the more ordinary type (except the exclusivity implication to be discussed shortly), Roelofsen and Van Gool (2010, fn. 6) say that questions do not imply exhaustivity at all – but as Biezma and Rawlins note (fn. 20) they overlook thematic exhaustivity.

Against a "polar" view of rising questions

That rising questions indicate that something else may be relevant is, to my awareness, commonly accepted. Approaches differ in what they take this "something else" to be. The above examples favor what I will call the "unrestricted view": rising questions do not impose any restriction except that the unmentioned propositions must be relevant, or in current terms main-thematic. This is Biezma and Rawlins's understanding of the phenomenon (in line with Bäuerle 1979), and it is the view that I adopt in this chapter.

A different understanding of the phenomenon is suggested by the common labels "polar question" and "yes/no question", used primarily for simple rising questions like (4a). These labels suggest, at least to one with a pragmaticist mindset, that the speaker of a simple rising question would necessarily be interested in knowing (perhaps exclusively) the *polarity* of a proposition, i.e., its truth *or falsity* rather than just its truth (cf. chapter 5 on the typical asymmetry of themes). I will refer to this understanding of the empirical facts as the "polar view". Roughly, the two views can be thought of as subscribing to the following approximate paraphrases of a simple rising question:

(6) Was John at the party? (H%)
  a. "Was John at the party, or...?" (unrestricted view)
  b. "Was John at the party, or not?" (polar view)

That something like the polar view is widespread may be suggested not only by the label "polar question", but also by what Biezma and Rawlins call the "standard" (p.391) semantic account of interrogatives (which they argue against; e.g., Hamblin 1973; Groenendijk and Stokhof 1984; Larson 1985; Han and Romero 2004b; Roelofsen and Van Gool 2010; Pruitt and Roelofsen 2011; and in part also Biezma 2009). Such accounts assign to simple rising questions like (6) a

semantic object containing both the proposition and its negation, in line with the paraphrase in (6b):

$$\{^{\wedge}Pj, ^{\wedge}\neg Pj\}$$

But while superficially suggestive of the polar view as I have conceived of it, i.e., the view that one who asks a simple rising question has symmetrical interests, to assume this type of semantic object for simple rising questions does not necessarily commit one to the polar view. Whether it does depends, after all, on whether and how directly one relates the symmetrical semantic object to a notion like relevance and speaker interests, and on whether or not one assumes any additional semantic dimensions (e.g., Roelofsen and Van Gool (2010) and Pruitt and Roelofsen (2011) assume asymmetrical "highlighting" in addition to the symmetrical object).

Whether or not the polar view is as widespread as the common labels and the semantic objects suggest (at least superficially), the empirical facts seem to favor the unrestricted view. For instance, Bäuerle (1979) notes that the range of expected responses to a rising question depends on accent placement in a way that one would expect if the underlying theme may vary:

(7) a. A: Was *John* at the party?
L*H H%
B: Mary was. / (?) He was at school.

b. A: Was John at the *party*?
L*H H%
B: (?) Mary was. / He was at school.

Relatedly, Bolinger (1978b) notes that rising questions and explicitly polar questions with "...or not", like the paraphrase in (6b), have very different uses, correlated with the fact that only the latter exhibit what Biezma (2009) calls the "cornering effect": unlike simple rising questions (e.g., (4a)), "or not"-questions do not permit responses other than the two disjuncts (perhaps even more so than ordinary falling disjunctive questions, e.g., (5b)):

(8) A: Was John at the party, or not?
L*H H% H*L L%

B: (?) Mary was.
H*L L%

I am unaware of accounts of these facts that subscribe to the polar view (though Groenendijk and Stokhof (1984, p.423) briefly suggest that we try to cope with (7) by assuming that it involves a thematic discontinuity). Moreover, I am unaware of arguments in favor of the polar view as I have characterized it, i.e., the view that the interests of a speaker who asks a simple rising question are symmetrical. (This is not to say that no arguments have been given for the "standard" semantic account regardless of its connection to relevance; for a discussion and arguments against such accounts see Biezma and Rawlins 2012.)

In light of the foregoing I adopt the unrestricted view, i.e., that rising questions indicate thematic non-exhaustivity without any other necessary restrictions on the type of theme – this is what I will show the ICM-based account can explain. I will also keep avoiding the common labels "polar question" and "yes/no question", which, given a pragmaticist mindset, are misleading if the unrestricted view is correct. I will also avoid the label "alternative question", which is commonly used for falling disjunctive questions. After all, according to the unrestricted view, simple rising questions are also alternative questions, in the sense that the underlying theme will often contain multiple propositions. The difference resides only in how many alternatives are explicitly mentioned and whether there are any unmentioned thematic alternatives. In any case, the labels I use are preferable because they are more theory-neutral, more purely descriptive.

Within the current approach, the symmetrical type of semantic object that many authors assign to simple rising questions can be regarded as a semanticized derivative of an effect of the Pruning Principle, namely that the complements of thematic propositions are also worth sharing. However, conceived of as such, these semantic objects omit an important aspect of the Pruning Principle, namely that sharing the complements will generally have lower precedence, hence not be part of the same theme. Chapter 4 explored some of the consequences of this approach with regard to exhaustivity implicatures.

2.2 Exclusivity and sufficiency

The other two implications that falling questions have but rising questions lack, besides thematic exhaustivity, are the following:

(ii) **exclusivity:** the speaker believes that at most one state of affairs in the attentional intent (plus those which it entails) is the case;

(iii) **sufficiency:** the speaker believes that at least one state of affairs in the attentional intent is actually the case (less robust for simple questions).

I will first discuss disjunctive questions, which have received the most attention in the recent literature.

Disjunctive questions

For a disjunctive question, exclusivity amounts to "not both", and sufficiency to "not neither". For instance:

(9) A: Was John at the party, or Mary?
L*H H% H*L L%

$\mathcal{A}_0 = \{^Pj, ^Pm\}$

Given the attentional intent, I take the exclusivity and sufficiency implications to be the following:

Exclusivity: $\Box\neg Pjm$ Sufficiency: $\Box(Pj \vee Pm)$

These implications have received considerable attention in the recent literature (e.g., Bartels 1999; Aloni and Égré 2010; Rawlins 2008; Biezma 2009; Groenendijk and Roelofsen 2009; Roelofsen and Van Gool 2010; Pruitt and Roelofsen 2011; Biezma and Rawlins 2012). I shall take their presence on falling disjunctive questions and their absence on rising disjunctive questions for granted, and concentrate here on the precise nature of the exclusivity and sufficiency effects, namely on whether falling disjunctive questions also have corresponding *intents*.

It is commonly claimed that the exclusivity and sufficiency of disjunctive questions are not part of what the speaker "means" (say, "asserts") but rather, e.g., of what is "presupposed" (e.g., Bartels, 1999; Aloni and Égré, 2010; Rawlins, 2008; Biezma, 2009; Biezma and Rawlins, 2012) or "imposed" on the common ground (Pruitt and Roelofsen, 2011). Since these proposals are not embedded in a more general theory of when a rational speaker would and would not "presuppose" or "impose" something, I think that not much weight needs to be attached to these particular labels – they are used, to my understanding, primarily to mark an opposition with what is "asserted". In current terms, these characterizations suggest that the exclusivity and sufficiency implications of questions do not serve to convey intents; they are only implications. In this regard questions would be different from the corresponding assertions:

(10) A: John was at the party, or Mary.
L*H H% H*L L%

$\mathcal{A}_0 = \{^Pj, ^Pm\}$ $p_0 = ^(Pj \vee Pm)$ $p_1 \subseteq ^\neg Pjm$

Sufficiency is simply part of the direct informational intent (p_0), and exclusivity is arguably (entailed by) an indirect intent (p_1), i.e., an exhaustivity implicature, as argued in chapter 4.

This purported difference between questions and assertions, i.e., that exclusivity and sufficiency are intents only in the case of assertions, may be supported by the fact that in response to a question it is harder to target the exclusivity and sufficiency with "yes" or "no". For instance, in (11) the responses are quite strange, whereas in (12) they are fine:

(11) A: Was John at the party, or Mary?
L*H H% H*L L%

B: a. (?) Yes, John or Mary. / (?) No, neither was there.
b. (?) Yes, not both. / (?) No, both were there.

(12) A: John was at the party, or Mary.
L*H H% H*L L%

B: a. Yes, John or Mary. / No, neither was there.
b. Yes, not both. / No, both were there.

The judgments in (11) are in line with Roelofsen and Farkas 2015 (their (16)); my impression that the responses in (12) are fine, in particular (12b), is in line with experimental results by Destruel et al. (2015), who find that purported exhaustivity implicatures can be contradicted by "no" (and preferably so, compared to "yes, but"). This does not mean that the responses in (12b) are exactly as smooth as those in (12a) – after all, the responses in (12a) target A's direct intent whereas those in (12b) target an indirect intent, and the greater prominence of the former (according to assumption 4.3 in chapter 4) could plausibly have some effect. But it seems that both (12a) and (12b) are fine in principle, and this is what I will assume.

The contrast between (11) and (12) bears on the intent-status of the exclusivity and sufficiency implications in the following way. Destruel et al.'s explanation for their experimental findings is that "yes" and "no" normally affirm or deny only implications that are "at issue", say, included in some theme of reasonably high precedence (see Goodhue and Wagner 2016 for a recent overview of accounts of "yes" and "no"; they adopt a similar view). I believe that this generalization is descriptively accurate, but it can be restated in a more explanatory way (in line with the perspective of anaphora resolution in Roberts 2011): "yes" and "no" express intents in their own right, which must of course be worth sharing, and hence, assuming that the Continuity Principle is complied with, should have been worth sharing to begin with, i.e., at the time of A's initial utterance. Either way, given this generalization, a possible explanation for the contrast between (11) and (12) is that the sufficiency and exclusivity implications are thematic in (12) but not in (11), and likewise for their negations (though these need not be part of the same theme, e.g., they could be worth sharing by virtue of the Pruning Principle). Since what is athematic cannot be an intent, the sufficiency and exclusivity implications of A's initiative cannot be intents in (11), whereas in (12) they are, namely the direct intent and an indirect intent (exhaustivity implicature), respectively.

The foregoing may corroborate the aforementioned common claim that the exclusivity and sufficiency implications of questions, unlike assertions, are not intents, but only if the proposed explanation for the contrast between (11) and (12) is the correct one. To my awareness no satisfactory alternative explanation is available in the literature – but I will not currently support this with an argument. Doing so would distract too much from the main point, and besides: the intended conclusion, i.e., that the exclusivity and sufficiency implications are intents only in the case of assertions, is commonly assumed anyway, also by authors who try

to explain the contrast between (11) and (12) very differently (e.g., Roelofsen and Van Gool 2010; Roelofsen and Farkas 2015). Therefore, in the remainder of this chapter I shall assume that the exclusivity and sufficiency of questions are not intents, and take this as something that any satisfactory account of the exclusivity and sufficiency effects of questions should explain. (Once this is explained, this will then lend further credibility to the proposed explanation for the contrast between (11) and (12) – but I will not return to this matter.) Prospects for the ICM-theory are good: at least intuitively, the difference in intent-status seems to resonate well with the current assumption that questions would lack a main informational intent.

Sufficiency of simple questions

Exclusivity is vacuous in simple falling questions, since "at most one" is trivially satisfied if there is only one proposition in the attentional intent. But sufficiency of simple falling questions amounts to the truth of that single proposition. Now, to say that simple falling questions always imply the truth of the questioned proposition may be a bit too strong, for reasons to be explained below. But the existence at least of something like a sufficiency *expectation* has frequently been noted. For instance, Hedberg, Sosa, and Fadden (2004, p.2) write that "fall on a positive yes/no question indicates more of an assertion of the positive proposition", and that "the speaker is expecting that the hearer will agree and is trying to elicit confirmation of this". Likewise, Bartels (1999) notes that falling questions have an "assertive" use (p.128). Nilsenova (2006) notes that simple falling questions have been described in the literature as "confirmation-seeking", "biased", "assertion-like", and "conducive" (although her experimental results do not support this, but this is arguably a consequence of her experimental design, as I will point out further below). Relatedly, Banuazizi and Creswell (1999) classify falling questions as "non-genuine", in the sense that the speaker either knows the answer or does not desire/expect an answer. Similarly, Hedberg and Sosa (2011) propose, based on a corpus study, that falling simple questions are "less inquisitive".

Some examples reported by Hedberg and Sosa are the following (their (2)-(5)):

(13) a. Can we talk about the job things now? (L%)
b. Is that right? (L%)
c. Do you have a cold? (L%)
d. Did I tell you that I have a new job? (L%)

If we imagine a reasonably typical context, examples (13a,b,c) indeed seem to imply that the speaker expects a positive response. But (13d) is perhaps more naturally (though not necessarily) understood as inviting a *negative* response: it seems to me that the speaker may be well aware that it is the first time she mentions her job – she may use the question as a way of casually introducing

the topic and effectively inviting the addressee to ask for more information. This potential counterexample notwithstanding, I will assume that the basic pattern to be accounted for is that of (13a,b,c), because their sufficiency effects align with those of falling disjunctive questions, suggesting that it is the broader, more basic phenomenon. Of course this means that counterexamples like (13d) will have to be explained by identifying a counterforce. For instance, one could try to account for (13d) in terms of a feigned expectation (which may well last a couple of dialogue moves: "Really?! I didn't tell you?!"), which could plausibly serve a rhetorical function comparable to the hedge "you probably already know this, but...", which perhaps need not be genuine either. But in what follows I will set this counterexample aside.

To treat the sufficiency effects of simple and disjunctive falling questions as essentially the same phenomenon does not mean that there can be no differences between the two. For instance, it seems (e.g., from characterizations in the literature) that the sufficiency implication of simple questions is less robust, perhaps often a mere expectation rather than an actual belief. An account of the underlying generalization must be flexible enough to allow for such differences, and ideally explain them. A plausible starting point for such an explanation could be the following. In the case of disjunctive questions, taking oneself to know the sufficiency of the question is compatible with not knowing the answer (i.e., which disjunct), but in the case of a simple question there is a tension: believing in its sufficiency entails taking oneself to know its single answer, and this raises the issue of why the speaker asked the question to begin with. This will be made more precise further below, after first accounting for the sufficiency implication of simple and disjunctive falling questions alike.

3 An ICM-based account

3.1 Preliminary: formalizing opting out

For the sake of explicitness and clarity I will propose a simple formalization of opting out. This formalization will trickle down to the formalized intents of the ICM theory and thereby derive prediction 12.2 in a formal way, i.e., that intonational compliance marking on questions pertains only to the A-maxims and Manner.

Recall that the unary constant MAXIMS was defined in chapter 2 (definition 2.14) such that:

$$\textsc{Maxims}(\mathcal{T}) = \begin{pmatrix} \textsc{Manner} \wedge \\ \textsc{A-Maxims}(\mathcal{T}) \wedge \\ \textsc{I-Maxims}(\mathcal{T}) \end{pmatrix}$$

And pragmatic models were required to validate this definition. In order to formalize opting out, let us make the interpretation of MAXIMS more flexible. In

particular, for any theme $\mathcal{T}$ the expression $\textsc{Maxims}(\mathcal{T})$ may be assigned either the above interpretation or the following variant, from which the I-maxims have been removed:

$$\textsc{Maxims}(\mathcal{T}) = \left(\begin{array}{c} \textsc{Manner} \wedge \\ \textsc{A-Maxims}(\mathcal{T}) \end{array} \right)$$

Indeed, we may in principle let Maxims denote any combination of maxims appropriate for a given type of utterance in a given type of context (e.g., normal conversation, a quiz, a theatre exercise).

Once the definition of pragmatic model is loosened to allow for different interpretations of the constant Maxims – but I will leave such a loosening implicit – we can easily set up a pragmatic utterance model for a given example in such a way that the right maxims apply relative to the right themes. To this end we may adopt some crude but convenient abbreviations, say, an expression $\textsc{All-Maxims}(\mathcal{T})$ that is true if and only if $\textsc{Maxims}(\mathcal{T})$ is defined in the original way, and an expression $\textsc{No-I-Maxims}(\mathcal{T})$ that is true if and only if it is defined in the second way, i.e., without the I-maxims. Formally, let us say that every pragmatic model must validate the following definitions (in addition to the definitions of the maxims):

$$\textsc{All-Maxims}(\mathcal{T}) = \left(\textsc{Maxims}(\mathcal{T}) = \left(\begin{array}{c} \textsc{Manner} \wedge \\ \textsc{I-Maxims}(\mathcal{T}) \wedge \\ \textsc{A-Maxims}(\mathcal{T}) \end{array} \right) \right)$$

$$\textsc{No-I-Maxims}(\mathcal{T}) = \left(\textsc{Maxims}(\mathcal{T}) = \left(\begin{array}{c} \textsc{Manner} \wedge \\ \textsc{A-Maxims}(\mathcal{T}) \end{array} \right) \right)$$

In pragmatic models, the constants $\textsc{All-Maxims}(\mathcal{T})$ and $\textsc{No-I-Maxims}(\mathcal{T})$ defined thus can be used as a simple on/off switch for the I-maxims, to be included among the formal assumptions for a given example. To illustrate, consider the simple falling question of (1b), repeated here with some formal assumptions including $\textsc{No-I-Maxims}(\mathcal{T})$:

(14) A: Was John at the party?
H*L L%

$\mathcal{A}_0 = \{^\wedge Pj\}$ $\mathcal{T}_0(^\wedge Pj)$ $\textsc{No-I-Maxims}(\mathcal{T}_0)$
$p_4 = {}^\wedge\Box\, \textsc{Maxims}(\mathcal{T}_0)$

A pragmatic utterance model for this example (which, recall, must make all formal statements in the example true in the actual world) will interpret Maxims in such a way that, in the actual world, relative to the main theme, the I-maxims do not apply. Since the interpretation of Maxims, like the intents and themes of an utterance, is (constitutively) determined by the speaker's intentions, the speaker herself must know it. This is a normality assumption, say, "maxim introspection",

that we must add to the definition of *normal models* – but again I will leave the required refinement implicit. What this normality assumption ensures is that in all normal pragmatic utterance models for (14) the constant MAXIMS receives the desired interpretation not just in the actual world, but also in the speaker's belief worlds.

Now, since the intent of the low boundary tone in (14) is stated in terms of the constant MAXIMS (and defined as such in chapter 7), fixing the interpretation of MAXIMS directly affects intonational meaning. Since in any normal pragmatic utterance model for (14) the truth of NO-I-MAXIMS($\mathcal{T}_0$) fixes the interpretation of MAXIMS($\mathcal{T}_0$) in the speaker's belief worlds in a way that excludes the I-maxims, the truth of p_4 does not entail the existence of a compliant informational intent. Conversely, if the boundary tone in (14) had been high, then the truth of its intent could have been blamed only on a suspension of an A-maxim or Manner. This is exactly what prediction 12.2 states, but derived in a more formal way.

Of course, which maxims apply must be understood also by an audience, lest they draw the wrong conclusions; this could be an aspect of the maxim of Compliance Transparency (chapter 4). Here context may of course play a role; but in the case of questions in a more ordinary context, the fact that the I-maxims do not apply must be signaled by interrogative mood (and the tentative assumption 6.8 in chapter 6 about the contents of interrogatives could be appropriately refined). That is, the truth of NO-I-MAXIMS($\mathcal{T}_0$) in (14), should ultimately be pragmatically derivable from a specification of the semantic contents of an interrogative sentence, in which case an explicit use of NO-I-MAXIMS($\mathcal{T}_0$) in (14) will be rendered redundant. For now, in order to remain neutral with regard to the semantics of interrogatives (like assumptions 6.7 and 12.1), I will keep using NO-I-MAXIMS($\mathcal{T}_0$) directly (or its counterpart ALL-MAXIMS($\mathcal{T}_0$)), as in (14).

Having clarified the notion of opting out, i.e., what I assume questions do, the remainder of this section will apply this to the phenomena at hand. In the next subsection I will present an account of the thematic exhaustivity, exclusivity and sufficiency implications of falling questions. Subsequently I will explain why rising questions lack such implications, and why questions may often rise to begin with.

3.2 Account of falling questions

Thematic exhaustivity

Consider again the simple falling question in (14) above, where, note, the theme is only partially formally specified. In chapter 3 I explained (there for example (12)) that we can derive that, for any state of affairs to which no attention was drawn in (14), the speaker must consider it either athematic or not possible (or not possible independently of anything more specific to which attention was drawn, but there

is no such thing). For instance, we can derive that, if the intonationally conveyed intent p_4 is true, the following holds:

$$\Box\neg\mathcal{T}_0(^\wedge Pm) \vee \Box\neg Pm$$

As I explained in chapter 3 (prediction 3.10), this means that even if Mary's presence is thematic when (14) is uttered it will no longer be thematic by the time the next speaker responds. This may already account for the contrasts in (4) and (5) given earlier, i.e., that falling simple and disjunctive questions do not really allow for responses other than the disjuncts.

In order to derive actual thematic exhaustivity, i.e., that nothing else is thematic for the question itself (not just for the response), it suffices if we assume that the theme of (14) was not inherited from some prior utterance but selected by speaker A herself. I assume that this is normally the case for questions:

12.4. Assumption. Questions normally serve to introduce a new theme to the conversation, selected by the questioner. (Assertions may more often serve to address a pre-existing theme.)

(This is similar in spirit to assumption 9.3 in chapter 9, namely, that purely attentional contributions must have some effect on the set of goals.) Now, if indeed speaker A in (14) was the one who selected the theme, then the Reasonable Goal Principle entails that if A did not consider Mary's presence possible, he would not have selected it as a goal, i.e.:

$$\Box\neg Pm \rightarrow \Box\neg\mathcal{T}_0(^\wedge Pm)$$

Combining this with the first result above yields:

12.5. Fact. PROOF IN APPENDIX

For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0\rangle$ for (14), assuming that $\mathcal{T}_0$ is chain-complete (cf. chapter 3):

$$\mathbf{M}, w_0 \models (^\vee p_4 \wedge \underbrace{(\Box\neg Pm \rightarrow \Box\neg\mathcal{T}_0(^\wedge Pm))}_{\text{from the Reasonable Goal Principle}}) \rightarrow (\Box\neg\mathcal{T}_0(^\wedge Pm))$$

That is, Mary's presence must be athematic – and the same holds for basically any state of affairs to which the question draws no attention. An analogous result obtains for the falling disjunctive question in (2b), repeated here with some formal assumptions for the sake of explicitness:

(15) A: Was John at the party, or Mary?
L*H H% H*L L%

$\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm\}$ $\mathcal{T}_0(^\wedge Pj)$ $\mathcal{T}_0(^\wedge Pm)$ No-I-Maxims($\mathcal{T}_0$)
$p_4 = {}^\wedge\Box$ Maxims($\mathcal{T}_0$)

In this case, it can be proven that (if the intonational intent is true and the Reasonable Goal Principle is complied with) nothing except John's presence and Mary's presence is believed to be thematic.

More generally, the following is predicted:

12.6. Prediction. **Thematic exhaustivity:**
Falling simple and disjunctive questions imply that their theme is exhausted by the attentional intent.

The same is in fact predicted for any falling question, including constituent questions, but I will not discuss the adequacy of this generalization here. Moreover, nothing *stronger* is predicted, i.e., no "ordinary" exhaustivity of the sort that was the topic of part I of this dissertation. Note that prediction 12.6 entails also that, for the falling disjunctive question in (15), John and Mary's joint presence ("both") and their joint absence ("neither") must be athematic. As we will see, the exclusivity and sufficiency implications of (15), i.e., "not both" and "not neither" can be derived from these thematic exhaustivity implications – and similarly for the sufficiency expectation of the simple falling question in (14). I will first discuss the sufficiency effects.

Sufficiency

According to the Thematic Organization Principle, a rational questioner will organize her goals into themes in a way that maximizes, among other things, the expected efficiency and smoothness of the ensuing conversation (chapter 2). Following Groenendijk and Roelofsen 2009, discussed further below, I intend this to entail that a rational speaker will prefer to introduce a theme that the addressee will be able to compliantly address. (This may or may not align with an intuitive notion of "smoothness" – certain thematic discontinuities may well feel smooth.) Compliantly addressable themes must contain at least one proposition that the addressee takes to be true, for otherwise the addressee will face an I-Quality/I-Relation clash. Now, as a questioner one may not know exactly what the addressee does and does not know, but at the very least one can try to ensure that the theme contains a true proposition, i.e., that the theme covers ones own epistemic state – and this is equivalent to the sufficiency implication.

For this line of explanation to work, speakers must be permitted to expand themes for the sake of smoothness:

12.7. Assumption. **Thematic widening:** In order to maximize expected smoothness, a speaker who introduces a new theme may, the Reasonable Goal Principle permitting, add a proposition to a theme that is not primarily relevant (but, presumably, not one that is completely uninteresting, either).

This is a further explication of the Thematic Organization Principle. It lets us say, for instance, that if speaker A, when uttering the disjunctive question in (15), had not believed that at least one of the two disjuncts was true (i.e., sufficiency), he could have added "or perhaps neither?" to give the addressee more room to maneuver and maximize expected smoothness. Since he didn't, he must have believed that the "neither"-proposition is false, i.e., that one of the disjuncts was true.

More generally, thematic widening enables speakers who introduce a theme to widen it until they believe that it contains a true proposition – and they will if they care about smoothness. And if this holds for the theme, then from thematic exhaustivity it follows that the same holds for the attentional intent: the speaker believes that at least one of the propositions in the attentional intent is true. In sum:

12.8. Prediction. **Sufficiency:**
Falling questions imply that the speaker believes that at least one of the propositions in the attentional intent is true – though this is less robust in the case of simple questions (for reasons to be explained).

Simple falling questions will be discussed shortly.

As I explained in section 2, the exclusivity and sufficiency effects appear not to be intents, unlike the analogous effects of disjunctive assertions. The exclusivity effects remain to be accounted for, but as far as sufficiency goes its non-intenthood follows straightforwardly from the assumption that questions lack a main informational intent (assumption 6.7 in chapter 6): if it would have been rational to convey such an intent, the speaker would have done so, by uttering a declarative sentence rather than an interrogative.

Lastly, note that the generality of prediction 12.8 is not compromised by the parenthesized, plausible restriction in assumption 12.7: since (conjunctions of) negations of thematic propositions, even if they are not primarily relevant, will always be worth establishing by virtue of the Pruning Principle, the "neither"-proposition will never be completely uninteresting, hence it can always be added to a theme to ensure smoothness.

Sufficiency of simple falling questions

As for why the sufficiency implication of simple falling questions may be less robust, this can be accounted for as follows. In section 2 I already suggested that an actual sufficiency implication would contradict the typical reason for asking a question rather than making an assertion, namely, that the questioner did not already have an answer. More precisely, for a simple falling question:

1. suppose that the question is *genuine*, in the sense that the speaker was unable to make an assertion – this means that there must have been a clash among the I-maxims (assumption 4.5 in chapter 4);

2. since there is no relevant uncertainty about the theme (given compliance with A-Relation and A-Quantity), and clarity is not compromised in any way (presumably, and given the L%), there can only be an epistemic I-Relation/I-Quality clash (chapter 8);

3. suppose that sufficiency is believed to be true;

4. since sufficiency is equivalent to the single proposition mentioned, it is believed to be thematic (by A-Relation);

5. since something is believed to be both thematic and true (3. and 4.) there is no I-Relation/I-Quality clash, contrary to 2.;

6. hence either the question is not genuine (contrary to 1.), or sufficiency is not believed to be true (contrary to 3.).

(An analogous derivation for a disjunctive falling question would break at step 4.)

Since the sufficiency implication derives from considerations of smoothness, the second disjunct of 6. implies that smoothness considerations must for some reason be less important in the given context. Altogether, the two disjuncts of 6. predict several circumstances in which we may expect simple falling questions:

(i) questions to which the questioner knows the answer, say, "rhetorical" questions (contrary to 1.);

(ii) questions for which smoothness does not matter because they are not meant to be answered, but merely "put out there";

(iii) questions for which smoothness does not matter (or matters less) because of the context;

There may be additional, more "abnormal" scenarios, e.g., where thematic widening is for some reason unavailable, but I will set such cases aside.

Categories (i) and (ii) correspond to the circumstances that Banuazizi and Creswell (1999) understand to license falling simple questions. Regarding (i), a more complete account of falling questions would also have to explain *why* a speaker would ever ask a rhetorical question, a matter that I will leave for future work – the current account predicts only *that* simple falling questions can be used in that way. Category (ii) may explain why Nilsenova (2006) found no sufficiency expectation for falling questions in her experiment: participants were presented with a series of questions in isolation, not as part of a dialogue, and were asked to judge whether these expressed a bias. Category (iii) perhaps includes contexts like

a police interrogation, which for instance Gussenhoven (1984, p.207) associates with simple falling questions, but also circumstances in which smoothness is simply the least of the speaker's concerns, e.g.:

(16) *(The speaker, A, lost his wallet at the party, and the only one who might return it to him is John. A knows that it is very unlikely that John was at the party, but is desparate and asks anyway:)*

A: I know he had an exam the next day, but he's my last hope:

Was John at the party?
H*L L%

This seems to me possible even though the speaker does not believe or even suspect that John was at the party.

The foregoing suggests that *disjunctive* falling questions too may lack a sufficiency implication ("not neither"), namely, if these are, according to the above categorization, (ii) merely "put out there", or (iii) used in a context where smoothness matters less. However, an important predicted difference is that simple falling questions *must* be used in one of these ways (or (i), rhetorically), whereas disjunctive falling questions are also compatible with a more ordinary (non-rhetorical, sufficiency-implying) interpretation. Since the availability of an ordinary interpretation may prevent a non-ordinary interpretation, it may be quite difficult to imagine a disjunctive falling question without a sufficiency implication – but let us try.

The following is a disjunctive variant of (16), i.e., a supposed example of category (iii):

(17) *(As in (16), but with* two *individuals who might bring salvation. The speaker knows that it is very unlikely that John or Mary was at the party.)*

A: I know they had an exam the next day, but they are my last hopes:

Was John at the party, or Mary? (Probably neither...)
H*L % (!)H*L L%

This type of utterance, with its intended lack of a sufficiency implication, seems to me conceivable, but I leave a proper empirical assessment of its predicted felicity to future work. Note that the intonation contour is the variant given earlier, in (3b), which lacks the prefinal boundary tone. This is expected to be necessary for the intended interpretation, because the required disposition of not caring about smoothness is practically incompatible with the disposition to facilitate comprehension by indicating non-compliance halfway.

In sum, the proposed account of the sufficiency implications of disjunctive and simple falling questions is compatible with the fact that this implication is less robust in the case of simple falling questions. In fact it predicts the somewhat non-ordinary uses (e.g., rhetorical) of the latter. Moreover, examples (16) and

(17), if my judgments are representative, seem to support the proposed account, i.e., that the sufficiency implication derives from considerations of smoothness.

Exclusivity

It would be tempting to just assume that themes are necessarily closed under intersection – this is sometimes assumed for notions of relevance (e.g., Spector, 2007) – and to derive the exclusivity implication of falling disjunctive questions through A-Quantity: since the disjuncts are thematic (A-Relation), their intersection must be thematic as well, and since no attention is drawn to it the speaker must consider it to be false (A-Quantity). However, in chapter 2 I already explained why the supposed closure condition on themes cannot hold in general, i.e., why it would not be rational: closure under intersection would occasionally require that goals be included in a theme that one knows will not be accomplished, contrary to the Reasonable Goal Principle. Since general closure under intersection cannot be rational, we cannot take this easy route to exclusivity. (Note that closure under intersection would also contradict the thematic exhaustivity implication, hence the theory would have to be amended in multiple respects.)

Rather than closure under intersection I assumed the Reasonable Closure Principle: themes are closed under intersection as far as the Reasonable Goal Principle permits, i.e., as far as these intersections can potentially be made common ground. Now, since falling disjunctive questions imply thematic exhaustivity, the intersection must be athematic as well, and the Reasonable Closure Principle provides us with two possible reasons for this athematicity:

a. the speaker considers the intersection to be false (i.e., exclusivity); or

b. not a., but the speaker believes that the intersection cannot be made common ground, i.e., that it is not *distributed knowledge*: the combined knowledge of all interlocutors does not entail it.

The availability of reason b. entails that, in principle, falling disjunctive questions are possible when the intersection is considered not false but merely unaccomplishable, which is weaker than the exclusivity implication we seek to derive.

In order to predict a proper exclusivity implication (reason a.) we must rule out reason b. To that end, I will invoke considerations of smoothness similar to those responsible for the sufficiency implication (i.e., assumption 12.7):

12.9. Assumption. **Resolvable themes preference:** In order to maximize expected smoothness, one should avoid introducing themes that one believes (or considers likely) will not be completely resolved (i.e., not all its propositions will be either confirmed or denied).

Crucially, the type of situation in which reason b. obtains is one where the theme is known not to be fully resolvable, hence assumption 12.9 predicts that speakers

will avoid it. (Note that assumption 12.9 does not block the account of sufficiency given earlier, because sufficiency can be achieved by adding the negations of thematic propositions to the theme, and doing so, like closure under negation more generally, does not affect complete resolvability.)

To illustrate, the type of situation in which reason b. obtains, and which is ruled out by assumption 12.9, is the following:

(18) A: (?) We will never know whether *both* John and Mary were there...
But at least one of them was. So, was John there, or Mary?
L*H H% H*L L%

According to assumption 12.9 (18) is odd, because A knows that the theme will not be completely resolved – either John's presence or Mary's presence will remain uncertain – hence he should have avoided this theme. Instead, he could have pursued a narrower theme like (19a), or, if this is not considered sufficiently likely to be resolvable either, he could have taken a more indirect approach like (19b) or (19c):

(19) a. A: ... Was John there?
b. A: ... What *do* we know?
c. A: ... Can we figure out whether John was there? Or Mary, perhaps?

It seems to me that (18) is indeed strange, and that (19a,b,c) are preferable, and this is what I will assume. If contrary to my own judgment (18) is in fact perfectly fine, that would mean that the preference captured by assumption 12.9 either does not exist or is too weak to rule out (18). Importantly, this would make our job easier rather than harder: the felicity of (18) would corroborate an account of exclusivity via the Reasonable Closure Principle, which predicts, after all, that reason b. should be available in principle.

Assuming, then, that (18) is strange, and that the preference captured by assumption 12.9 is real, reason b. is in general ruled out as an explanation for the implied athematicity of an intersection of thematic propositions (e.g., of the "both" proposition of falling disjunctive questions), leaving only reason a., i.e., exclusivity. Hence:

12.10. Prediction. **Exclusivity:**
In general, falling disjunctive questions imply that the speaker believes that at most one of the propositions in the attentional intent is true.

The precise extent of "in general" in prediction 12.10, and the degree to which (18) is predicted to be odd, depend on the strength and generality of the preference captured by assumption 12.9. I leave fine-tuning this parameter to future work.

Some further discussion In effect, assumption 12.9 serves to strengthen the effect of the Reasonable Closure Principle: together they entail closure of the

theme under possible intersections, which is stronger than closure under potentially accomplishable intersections (albeit not quite as strong as plain closure under intersection). This is because if a theme is closed under potentially accomplishable intersections but not under possible intersections, then the theme is believed not to be fully resolvable, and it will not be introduced according to assumption 12.9. The result, closure under possible intersections (in general, or at least for exclusivity-implying falling disjunctive questions) is the weakest possible constraint on themes that suffices for an account of exclusivity based on the implied athematicity of the intersection.

Assumption 12.9 may not be the only plausible way to obtain closure under possible intersections (and thereby exclusivity). For instance, an alternative way would be to assume that speakers generally do not take the epistemic states of their interlocutors into account when setting goals, or only to a limited degree, such that considering something possible is (to them) equivalent to considering something potentially accomplishable – though this does not seem too plausible in light of (18), where the speaker discusses real accomplishability prior to asking the question. Another alternative way would be to assume that even if closure under (possible) intersections is not strictly rational in all circumstances (say, if assumption 12.9 does not in fact hold, or is a mere tendency), it may have been rational often enough for this to have conventionalized, such that closing themes under (possible) intersections is now simply a linguistic convention of English (and, presumably, other languages).

However, the proposed explanation in terms of assumption 12.9 may have some advantages, depending on how the empirical facts turn out. First, besides accounting for the presumed oddness of (18), it also does not predict the same oddness for the declarative variant in (20):

(20) A: We will never know whether *both* John and Mary were there...
But John was there, or Mary.
L*H H% H*L L%

This is not predicted to be odd, because assumption 12.9 (and smoothness considerations more generally) pertain only to speakers who introduce new themes to the conversation, which is what questions serve to do (assumption 12.4). In contrast, in (20) the speaker may be addressing a prior theme, which after eliminating the "both"-proposition (by announcing that it is unaccomplishable) is no longer closed under intersection, as a consequence of which A's disjunctive answer does not imply exclusivity. It seems to me that (20) is indeed fine (hence does not imply exclusivity), which would be surprising for an account based on a more general requirement that themes be closed under (possible) intersections. (Conversely, if my judgment turns out not to be representative, i.e., if (20) is in fact as odd as (18), then the account based on assumption 12.9 cannot be correct as it is.)

Second, the proposed account explains why, as I pointed out earlier, the implied exclusivity of falling disjunctive questions is not an intent, unlike the exclusivity of

falling disjunctive assertions. In the case of assertions, which typically address a prior theme, the "both"-proposition may typically be thematic ((20) would be an exception). Since in that case the "not both"-proposition must be worth sharing as well, by virtue of the Pruning Principle, the exclusivity of assertions typically serves a purpose, and this is why the exclusivity of assertions is typically an intent (this echoes the account in chapter 4 of exhaustivity implicatures). In contrast, for questions the "both"-proposition was not thematic to begin with (thematic exhaustivity), hence there is no reason to believe that the "not both"-proposition was worth sharing, and therefore no reason to believe that the exclusivity is an intent. Lastly, the absence of a reason to believe that there is such an intent entails that there cannot be such an intent, or it would have violated I-Clarity. This accounts for the difference in intent-status between the exclusivity of questions and assertions – but the explanation is unavailable if one assumes that themes are necessarily closed under intersection (though it is available if one merely assumes closure under possible intersections).

In sum, I have outlined a plausible account of the exclusivity implications of falling disjunctive questions, based on the thematic exhaustivity implication plus, again, considerations of smoothness. I also pointed out two alternative lines of explanation whose predictions differ in subtle ways. A closer inspection of the relevant empirical facts was left to future work, but should my own judgments about the relevant examples turn out not to be representative, the foregoing discussion has at least clarified what is necessary for an account of exclusivity within the bounds set by the ICM theory, and how we may proceed.

3.3 Account of rising questions

Recall that rising questions lack the thematic exhaustivity, exclusivity and sufficiency effects of their falling counterparts (repeated from (1) and (2)):

(21) a. A: Was John at the party?
L*H H%

b. A: Was John at the party, or Mary?
L*H H% L*H H%

In order to explain this, and also why these questions have high boundary tones to begin with, we must investigate which maxim violation or suspension is to blame. Given prediction 12.2 this can only be a violation or a suspension of an A-maxim or Manner. (Thus, it is predicted that final high boundary tones in (interrogative) questions must be pragmatically quite different from final high boundary tones in the "declarative questions" discussed in chapter 9, which involve an I-Quality suspension.) To find out which maxim this is we must consider the range of possible clashes.

An overview of clashes among the A-maxims is given in appendix D. Clashes among the A-maxims and Manner may occur only if (i) the intent cannot be clearly conveyed all at once, yielding a temporary "clash" of A-Clarity; or (ii) the speaker is uncertain about the theme, yielding clashes involving A-Quantity or A-Relation (optionally accompanied by clashes involving A-Parsimony); or (iii) clear communication is compromised, yielding clashes involving A-Clarity and Content Efficacy. Case (iii) could obtain in (21) if, for instance, A was unsure whether "John" and "Mary" are the correct names (we may also imagine an interrogative variant of the I-Clarity-suspending rising declarative in chapter 9, example (7)) – but I will set this atypical scenario aside in what follows, and concentrate on (i) and (ii).

As for (i), to blame the rise on a temporary A-Clarity clash amounts to treating the rise as signaling *unfinishedness* (cf. rises in lists, chapter 10): the attentional intent has not yet been clearly conveyed. This means that some possible, thematic propositions exist, and are part of the attentional intent, to which no attention has yet been drawn. (To clarify: this does not mean that A-Quantity is violated – what falls short is only the expressed content, not the intent.) For instance, we may understand a rising question like (21a) to be just the initial part of a sequence like the following:

(22) A: Was John at the party? (Or was Bill there? Or Sue?)
L*H H% L*H H% H*L L%

A complete explanation of this use of rising questions would require a more precise account of when A-Clarity clashes in this way, i.e., when it requires that an intent be conveyed piece by piece. Plausibly, such an account would permit speaker A to continue or abort the list depending on answers given by his interlocutor along the way:

(23) A: Was John at the party? (H%)
B: No...
A: Or Bill? (H%)
B: Yes, Bill was there.
A: Okay, thanks.

Indeed, to elicit such answers along the way may be a good reason to reveal one's attentional intent (and thereby the theme) one piece at a time. The details of this type of maneuver do not matter for present purposes (e.g., how we may distinguish a single utterance with interruptions from a sequence of distinct utterances, with distinct themes and intents). What matters is that an understanding of rising questions in terms of option (i) accounts for their lack of thematic exhaustivity, exclusivity and sufficiency implications: the attentional intent is predicted to be larger than what is explicitly expressed, which means that it may cover more of the logical space, countering the sufficiency implication, and that it could potentially be closed under intersection, countering exclusivity.

As for option (ii), uncertainty about the theme, this amounts to blaming the high final boundary tone of rising questions on a suspension of A-Quantity or A-Relation (and optionally A-Parsimony). For instance, we may understand a rising question like (21a) as being roughly paraphrasable in two ways:

(24) a. A: Was John at the party (H%), or perhaps something else that's relevant?

b. A: Was John at the party (H%), if that is relevant at all?

Of these, (24a) conveys potential non-exhaustivity, and this suffices to block also the sufficiency implication, and the exclusivity implication in case of disjunctive questions. The paraphrase in (24b) also happens to convey non-exhaustivity: if the thematicity of John's presence is uncertain, then something else must be potentially thematic as well, since themes cannot be empty. But the latter does not generalize to (analogous paraphrases of) disjunctive rising questions, which are therefore in principle compatible with thematic exhaustivity, exclusivity and sufficiency. But, although compatible, even disjunctive rising questions do not *imply* thematic exhaustivity, exclusivity and sufficiency, in the way their falling counterparts do.

In light of assumption 12.4, i.e., that questioners tend to introduce new themes, it is important that speakers can introduce themes about which they themselves are uncertain. For instance, a speaker may wish to start a conversation that will help achieve some prior goal, without knowing exactly which pieces of information are relevant to that goal. Moreover, it seems to me plausible that speakers could also intentionally leave part of the theme indeterminate, for the addressee to fill in, in order not to corner the addressee. Such purposeful indeterminacy could be understood as a type of thematic widening, and assumption 12.7 could be refined so as to allow it – but I will leave this as a mere suggestion.

Summing up:

12.11. Prediction. **Non-exhaustivity of rising questions:**
Typically (i.e., if clear communication is not compromised), the high final boundary tone of a rising question must be blamed on a suspension of either

- A-Clarity (unfinishedness);
- A-Quantity ("something else may be relevant");
- A-Relation ("is this relevant?").

None of these implies exhaustivity (or exclusivity or sufficiency), and the first two even imply non-exhaustivity.

This accounts for the relevant lack of implications of rising simple and disjunctive questions.

The foregoing account of rising questions does not quite align with another, potentially intuitive approach, namely that the rise would indicate the omission of disjuncts for reasons of *conciseness* rather than clarity or uncertain relevance. The responsible clash could be one between Manner-Conciseness and A-Quantity, in which case certain thematic, possible states of affairs would be omitted from the attentional intent for reasons of conciseness; or it could be a clash between Manner-Conciseness and A-Clarity, in which case the attentional intent would itself be complete, but not completely expressed for reasons of conciseness. However, in appendix D I assume that such clashes do not in fact exist (and analogously for the I-maxims in chapter 8). That is, following Carston 2005, I assume that conciseness plays a role only as far as maximizing expected compliance with the other maxims allows. I think that the assumed unimportance of conciseness is plausible, and giving it up will add a layer of complexity to the theory that, at least for the moment, we may not need; it would require a more precise maxim of Manner, and/or a "mentionworthiness" parameter on top of the notion of theme, similar to the conciseness-based approaches to the symmetry problem that I criticized in chapter 5.

But perhaps part of the intuition that rising questions have something to do with conciseness can still be reconciled with my account, in particular with option (i), a temporary A-Clarity clash, in two ways. First, although in the case of option (i) the main reason for expressing the attentional intent one piece at a time is clarity, this clarity will of course be achieved due to the simpler, more concise pieces of utterance, and smaller pieces of attentional intent. Second, the piece by piece presentation of an attentional intent may elicit responses in between, as in (23), in which case the rest of the utterance may sometimes be dropped (and some underlying goal reached sooner), which benefits conciseness.

4 Comparison to existing work

To my awareness only few explanations exist of the thematic exhaustivity, exclusivity and sufficiency implications of falling questions. Most formal accounts describe some or all of these effects by incorporating them directly into the semantics (e.g., Roelofsen and Van Gool, 2010; Pruitt and Roelofsen, 2011; Biezma and Rawlins, 2012), much like Zimmermann's (2000) account of list intonation discussed in chapter 10. I will here discuss only what are to my awareness the more explanatory proposals: Biezma and Rawlins 2012, which is descriptively very similar and explanatorily somewhat similar to the current account, and Groenendijk and Roelofsen 2009, which aims to offer a more detailed explanation for the exclusivity and sufficiency implications of disjunctive questions. I will discuss each in turn.

4.1 Biezma and Rawlins (2012)

Biezma and Rawlins's (2012) account operates on a semantics that assigns objects to the relevant interrogatives that are identical to the attentional intents assumed here. Indeed, to my understanding the core of their account can be framed in attentional terms, and that is how I will present it. I will first discuss their account of the thematic exhaustivity implication, then sufficiency, and then exclusivity.

Thematic exhaustivity Biezma and Rawlins (p.388) assume that falling intonation contributes a "closure operator" in the compositional semantics (following Biezma 2009; Zimmermann 2000; and similar also to, e.g., Roelofsen and Van Gool 2010; Pruitt and Roelofsen 2011). They take this operator to semantically contribute a presupposition to the effect that, in current terms, the attentional intent must be equivalent to the theme. They do not spell out what a semantic presupposition is, but I assume that an utterance of a sentence that carries a semantic presupposition somehow implies that the speaker believes that what is presupposed is true.

From the current perspective, to say that the attentional intent must be equivalent to the theme combines the requirement imposed by A-Relation, that everything in the attentional intent must be thematic, with thematic exhaustivity, that nothing outside the attentional intent is thematic, where I derived the latter from compliance with A-Quantity, the Reasonable Goal Principle, and the assumption that questioners tend to be responsible for their themes. As such, the semantic presupposition that Biezma and Rawlins assume may be conceived of as a semanticized, less explanatory shortcut for the current pragmatic account.

As a semanticized shortcut their account is expected to generalize less well, for instance to cases where the speaker *isn't* responsible for selecting the theme. Indeed, their account of falling intonation may not extend to assertions: to assume that a falling assertion presupposes that the theme and the attentional intent are equivalent would prevent a rheme-pragmatic account of exhaustivity along the lines given in part I of this dissertation, according to which exhaustivity arises precisely because the attentional intent *isn't* equivalent to the theme.

Sufficiency Biezma and Rawlins derive the sufficiency implication from the assumed equivalence of theme and attentional intent, combined with an additional assumption (their (49i)):

(i) every theme must fully cover the common ground.

Their reliance on this assumption parallels my reliance on the assumption that speakers, for reasons of smoothness, tend to select themes that they believe contain a true proposition, i.e., that cover their epistemic state. Indeed, our approaches are very similar in this respect. However, to simply assume something like (i) rather than derive it from considerations of smoothness may, as a kind of shortcut,

again generalize less well. It is too rigid, for instance, in light of the perceived lesser robustness of the sufficiency effects of simple falling questions – to which for this reason they do not intend their closure/exhaustivity operator to apply. It may also be too rigid for purported cases of falling simple or disjunctive questions that lack a sufficiency expectation altogether, e.g., (16) and (17), where the speaker was too desperate to care about smoothness.

In addition to being more rigid, their assumption (i) is also slightly stronger, demanding not only that the *speaker* should take the theme to be sufficient, but that this is common ground. They do not motivate this aspect of their assumption, and it is not, to my awareness, necessary for an account of the empirical phenomena. Indeed, their assumption rules out a situation like the following, which seems to me quite ordinary:

(25) A: Hey, you probably know this! Was John at the party, or Mary?
L*H H% H*L L%
B: I have no idea; I didn't even know one of them would go.

Certainly speaker A *expected* that B would know the answer (if he had not expected this, he would likely have chosen an indeterminate theme to avoid cornering the addressee), and in that case B would also have known the sufficiency of A's theme. But it may well be *merely* expected, i.e., A does not need to take himself to know that B knows this, let alone that it should be common ground.

Exclusivity Biezma and Rawlins derive exclusivity again from the assumed equivalence of attentional intent and theme, this time combined with the following assumption:

(ii) every theme is such that in the common ground no two thematic propositions can be true together.

Since the theme and the attentional intent must be equivalent, the exclusivity of the theme, as required by (ii), automatically ensures the exclusivity of the attentional intent. As Biezma and Rawlins are aware (fn. 25), their particular formulation of (ii) is a simplification: it predicts the same exclusivity implication for a falling disjunctive question as for the same question with "or both" added – but this could of course be fixed by refining (ii). Recall that I derived exclusivity from the Reasonable Closure Principle: if the intersection of two thematic propositions is not itself thematic, the reason must be that it cannot be established, which through considerations of smoothness implies, in the case of questions, that it is considered false. This explanation does generalize to cases where a disjunct "or both" is added.

Compared to the Reasonable Closure Principle, their assumption (ii) is stronger, in two respects. First, it requires not merely that the "both"-proposition cannot be made common ground, but that it is actually believed to be false – and

this may, depending on the empirical facts, be too strong for cases like (18) and assertions like (20). Second, according to assumption (ii) not only must the "both"-proposition believed to be false, its falsity must also be commonly known. They do not motivate this aspect of their proposal, and it is not, to my understanding, necessary for an account of the relevant phenomena. And again (25) seems to me a potential counterexample.

In general, Biezma and Rawlins's account is descriptively very similar to the current account. The main difference is that their account is less explanatory and more rigid. I hope to have made plausible that this rigidity may be problematic, namely, that their account may not generalize as well to cases they do not explicitly consider.

4.2 Groenendijk and Roelofsen (2009)

An in some respects more explanatory account is presented in Groenendijk and Roelofsen 2009. They do not seek to account for thematic exhaustivity, but they do propose a pragmatic explanation for the exclusivity and sufficiency effects of falling disjunctive questions, e.g., (15), repeated here for ease of reference:

(15) A: Was John at the party, or Mary?
L*H H% H*L L%

$\mathcal{A}_0 = \{^Pj, ^Pm\}$

They informally describe the exclusivity and sufficiency effects as "suggested expectations", but what they claim to predict are implied beliefs, a difference that I will mostly ignore in what follows.

Although in (15) I have included the attentional intent, Groenendijk and Roelofsen's account in fact operates on a slightly different object, which they assign to the sentence by a semantics (*inquisitive semantics*):

$$\{^Pj, ^Pm, ^(\neg Pj \wedge \neg Pm)\}$$

This type of semantic object is somewhat in line with Karttunen 1977; Groenendijk and Stokhof 1984; I refer to Biezma and Rawlins 2012 for arguments in favor of a semantics, at least for unembedded interrogatives, that is more in line with the current attentional intents. In what follows I will mostly ignore this difference: the core of Groenendijk and Roelofsen's account can be explained in attentional terms, although I will point out some differences where relevant.

I will first discuss their account of the exclusivity implication, and then their account of the sufficiency implication. As we will see, in both cases their account shares some insights with the account I proposed, but it also faces some challenges.

Exclusivity Groenendijk and Roelofsen define a technical notion of *compliance*, comparable in status though not in technical details to the current rheme-pragmatic maxims, that renders a "both"-response to (15) non-compliant. They propose that the exclusivity effect can be derived as an explanation of why the questioner did not make the "both" response compliant, namely, by asking a different question. According to them, the only possible reason why the questioner did not make the "both" response compliant is that he considered it to be false.

The core of their proposal seems to be an implicit assumption, namely that the set of compliant responses should be closed under intersection unless these intersections are known to be false. If we conceive of compliant responses as responses that are thematic, then their implicit assumption entails closure of themes under possible intersections. Although I derived this condition from considerations of smoothness together with the weaker Reasonable Closure Principle (i.e., closure under potentially accomplishable intersections), the end result is the same.

However, Groenendijk and Roelofsen's particular implementation faces a technical challenge that mine doesn't. Presumably, what they have in mind is that a speaker can make the "both"-response compliant by asking, instead of (15):

(26) Was John at the party, or Mary, or both?

Indeed, this type of question is permitted in my account, and no exclusivity implication is predicted. However, Groenendijk and Roelofsen assign to (26) the exact same semantic object as (15), i.e., $\{^\wedge Pj, ^\wedge Pm, ^\wedge(\neg Pj \wedge \neg Pm)\}$. Hence they falsely predict an exclusivity effect also for (26). Moreover, they do not explain what question a speaker could have uttered instead of either (15) or (26) to make the "both" response compliant. It seems to me that the semantic dimension that is modeled by inquisitive semantics is not the type of dimension to which the pragmatic considerations they invoke are really sensitive.

Sufficiency Groenendijk and Roelofsen aim to derive the "not neither" implication by considering why a speaker would ask (15) rather than (27):

(27) Was John or Mary at the party?
L*H H%

$\mathcal{A}_0 = \{^\wedge(Pj \vee Pm)\}$

(The attentional intent is in line with, e.g., "highlighting" in Roelofsen and Van Gool 2010, and also with chapter 6 on the corresponding assertion.) Groenendijk and Roelofsen assign to this question the following semantic object:

$$\{^\wedge(Pj \vee Pm), ^\wedge(\neg Pj \wedge \neg Pm)\}$$

From the attentional intents, and also from Groenendijk and Roelofsen's semantic objects, it follows that (15) is more "inquisitive" than (27), i.e., the goals introduced by (15) are more demanding, because the propositions to be made common

ground are stronger. Groenendijk and Roelofsen assume that rational speakers prefer the less inquisitive (27) over (15) unless there is some reason why (27) cannot be rationally asked. According to them the only possible reason for asking (15) rather than the less inquisitive (27) is that the questioner already knows that the disjunction is true, and this would account for the sufficiency implication.

The type of theme-pragmatic pressure that Groenendijk and Roelofsen identify may be real: people may often ask less than what they actually want to know, e.g., they may ask (27) when what they really want to know would be more directly asked by (15). Groenendijk and Roelofsen conceive of this type of theme-pragmatic maneuver as a smoothness-enhancing strategy, just like *thematic widening* (assumption 12.7) and a preference for resolvable themes (assumption 12.9) are smoothness-enhancing maneuvers in the account I proposed: they increase the probability that some thematic propositions can be established. Let us call the theme-pragmatic maneuver on which Groenendijk and Roelofsen rely "thematic coarsening":

- **Thematic coarsening:** to maximize expected smoothness, a speaker may (at least temporarily) replace certain propositions one wants to know by weaker propositions, say, their unions.

More intuitively: whereas thematic widening consists in feigning an interest in propositions that one does not primarily care about, and the resolvable themes preference encourages (temporarily) feigning a lack of interest in propositions that one does care about, thematic coarsening involves both.

I think that a future, more precise Thematic Organization Principle will have to take each of these theme-pragmatic smoothness-enhancing maneuvers into account. However, Groenendijk and Roelofsen's particular implementation is problematic. Because they do not constrain when thematic coarsening should and should not apply, they predict many more "not neither"-implications than are actually witnessed, namely for any pair of propositions in the theme. For instance:

(28) Was John at the party, or Mary, or Bill?
L*H H% L*H H% H*L L%

$\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb\}$

Their account falsely predicts that the speaker must believe that two of the three individuals were there: namely John or Mary (= not neither John nor Mary), John or Bill, and Mary or Bill. Similarly, their account falsely predicts that the speaker in (29) must believe that both John and Mary were there (namely John or Mary, John or neither, and also Mary or neither):

(29) Was John at the party, or Mary, or neither?
L*H H% L*H H% H*L L%

$\mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge(\neg Pj \wedge \neg Pm)\}$

Indeed, since Groenendijk and Roelofsen treat this example as semantically equivalent to the original example, (15), their original account is inadequate also for the case that motivated it. This shows that they need some way to restrict the application of thematic coarsening, i.e., to make it apply to certain sets of disjuncts but not to others.

But even a suitably constrained thematic coarsening would arguably not be the mechanism responsible for the sufficiency implications. I take the contrast between (15) and (29), i.e., the effect of adding "or neither", to suggest that what matters for the sufficiency expectation is not (primarily) the *granularity* of the propositions in the attentional intent (which can be changed by thematic coarsening), but their *coverage* of the logical space (which can be changed by thematic widening) – and the latter is the core of my account. This generalization in terms of coverage is obscured by the semantic objects that Groenendijk and Roelofsen assume (see Biezma and Rawlins 2012 for more empirical reasons to avoid this type of semantic treatment).

In sum, my account shares with Groenendijk and Roelofsen's account certain core ideas, but their particular implementation faces some challenges. The shared ideas are that the exclusivity expectation derives from the fact that themes (or compliant responses) are to a certain extent closed under intersection, and that the sufficiency expectation derives from considerations of smoothness.

5 Conclusion

I have shown that the ICM theory generates a detailed account of the thematic exhaustivity, exclusivity and sufficiency implications, or lack thereof, of falling and rising sentential questions. It reproduces certain core ingredients of existing accounts, primarily Biezma and Rawlins 2012, and is explanatorily similar to the otherwise quite different approach of Groenendijk and Roelofsen 2009. At the same time, it paints a more nuanced empirical picture, a proper empirical assessment of which is left to future work.

The core assumptions on which this account relies, besides those of the ICM theory in a more narrow sense, are (i) that the I-maxims do not apply to questions, (ii) that themes tend to be closed under intersection as far as the Reasonable Goal Principle permits, (iii) that questions normally introduce new themes to the conversation, (iv) that speakers may widen their themes to avoid future clashes, and (v) that speakers prefer not to introduce themes that they know will not be completely resolved. Some of these assumptions already played a role in earlier chapters, and only assumptions (iv) and (v) were really new, though understood as further explications of the Thematic Organization Principle.

Chapter 13

Taking stock

> It is so easy to hide our ignorance under such expressions as the "plan of creation," "unity of design," etc., and to think that we give an explanation when we only restate a fact.
>
> (Darwin, 1859, p.482)

This dissertation presented a unified theory of exhaustivity and intonational meaning. In a nutshell: speakers have two types of communicative intention, namely informational and attentional intents, speakers of English and related languages use intonation to indicate whether their intents comply with a certain set of rationality criteria, and exhaustivity implications arise when attentional intents (are indicated to) comply. The theory was applied to a number of central puzzles regarding exhaustivity, and to various subdomains of intonational meaning.

Most chapters included detailed comparisons to the literature, which demonstrate how this dissertation advances our scientific understanding of conversation. The current, final chapter assesses the scientific value of this work at a more general level, by considering its overall explanatory potential, conceptual clarity, parsimony, falsifiability, and fruitfulness. Although different strands in the philosophy of science may disagree about what exactly these criteria entail, and about which criteria are subservient to which, for current purposes no philosophical depth is intended – the five criteria serve merely to organize the following remarks.

Explanatory potential

All substantive assumptions of the theory are intended to capture aspects of rational behavior, and to be reducible to a more general notion of rationality – although I have not shown that this is indeed the case. This potential reducibility to more general principles gives the theory its explanatory potential. In this respect the current theory compares favorably to most existing accounts discussed

in this dissertation, which often contain ad hoc assumptions, i.e., assumptions that are not motivated independently of the data to be accounted for (e.g., certain exhaustivity operators, that rising declaratives express a bias, or that rise-fall-rise would convey three types of uncertain relevance or incredulity). By preventing ad hoc assumptions, the theory's explanatory potential increases its potential to generalize to new phenomena, and increases the in principle falsifiability not just of the current theory but of future iterations, i.e., of the general research program.

Conceptual clarity

This dissertation consistently maintained several useful conceptual distinctions. Although none of these is new, they are sometimes overlooked or misunderstood. The most central distinctions are:

- between a scientific, cognitive theory of conversation and ordinary language philosophy (chapter 1);
- between rationality and compliance with the maxims (see primarily chapters 2, 7 and 8);
- between selecting and organizing conversational goals and forming communicative intentions (i.e., theme-pragmatics and rheme-pragmatics; chapter 2);
- between content, direct intent, indirect intent, and potential; and analogously between impliciture, implicature and implication (chapters 2, 4, 6);
- between the cancelability of implicature or pragmatic implications and their often erroneously supposed "weakness" (chapter 4);

Clear concepts delineate what can be meaningfully stated, they constrain one's theorizing, and potentially lead one towards explanations that might otherwise be overlooked.

Parsimony

Throughout this dissertation all substantive assumptions were made explicit, i.e., numbered and put in a frame. They are all simple, general statements that apply beyond the phenomena of primary interest. Moreover, as I mentioned above, all substantive assumptions can in principle be conceived of as capturing aspects of rational behavior; none requires a leap of faith – although there may be some wiggling room in the details. Most assumptions were motivated, furthermore, by pointing out comparable assumptions in the literature.

Few if any of these assumptions could have been omitted without leaving relevant parts of the framework bare: for the phenomena under consideration, something simply needs to be said about, among other things, the intents of

questions, intonational meaning, how clashes are resolved, which sorts of theme-pragmatic maneuvers are possible, and how clear communication is achieved. That few if any of the assumptions could have been omitted is a consequence in part of the broad range of phenomena covered, and in part of the modularity of the framework of Epistemic Pragmatics (and the frameworks from which it borrows): the auxiliary notions that subdivide the relation between beliefs, goals and what is uttered need to be interconnected somehow. This modularity keeps the basic assumptions simple, and the theory as a whole tractable. (A more monolithic theory could perhaps rely on (in some sense) fewer assumptions, but these would have to be more complex to achieve the same empirical coverage.)

The theory does not rely on any extraordinary assumptions about the semantics, whether on the informational side or on the attentional side, encouraged by the heuristic of Convention Minimalism. With regard to attentional intents, chapter 6 showed that their clear communication may not require a designated semantic notion, inviting a particularly parsimonious perspective on the semantics of interrogatives. Chapter 7 showed that the contents and/or intents of intonation can at least in part be explained on the basis of natural meaning.

Falsifiability

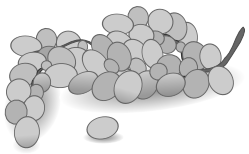
This dissertation solved concrete empirical puzzles by showing that the relevant patterns – say, implications or (in)felicity judgments – were predicted by the theory. This was done by deriving these predictions, along with several more peripheral ones, in a transparent and logical way from an explicit and in part formalized set of assumptions. To falsify the resulting predictions is to falsify the theory.

Of course the theory is not in all respects equally precise. Some assumptions and predictions contain hedges like “normally” and “other things being equal”, the semantic part of the theory was left largely implicit, the maxim of Manner was left informal, and to handle apparent counterexamples I occasionally invoked notions like impliciture, pretense and metalinguisticness, which have not been rigorously defined. These imprecise aspects do not, however, compromise the theory’s *in principle* falsifiability. For instance, notions like impliciture, pretense and metalinguisticness appear to be independently necessary, they are assumed by other authors, and they can in principle be studied independently of the puzzles for which I relied on them. The aim to maintain the theory’s explanatory potential commits us to predicting that, in the relevant examples, impliciture, pretense or metalinguisticness was rational for the speaker. This is a prediction that can be falsified once we have an independently motivated theory of when impliciture, pretense and metalinguisticness are rational.

Fruitfulness

I hope that this dissertation will enable and inspire much subsequent research, on a wide range of phenomena. Several features of this dissertation make this a realistic prospect. First, the main phenomena covered in this dissertation, and certain long-standing ideas that were revised, are particularly central to the field. Second, the theory's explanatory potential invites reductionist attempts. Third, explanatory potential increases the likelihood that eventual descriptive shortcomings of the theory will not be destructive but yield new insight. Fourth, the explicitness of the theory's assumptions, especially those that remained informal, reveals what work remains to be done; it invites attempts to plug in existing formalizations where available, or to develop new formalizations where necessary. Fifth, most assumptions reach far beyond the phenomena for which the theory was primarily developed.

In conclusion, this dissertation presented a unified theory of exhaustivity and intonational meaning that stands out from existing work in explanatory potential and conceptual clarity, that is parsimonious and falsifiable, and that offers a fruitful new perspective on a wide range of phenomena.



Appendices

Appendix A

Intensional Logic

1 Formal language

The definitions in this section are largely adopted from Gamut 1991, to which I also refer for more discussion of the formalism. Intensional Logic is a strictly typed language, based on Type Theory:

A.1. Definition. **Types:**
The set $\mathbf{T}$ of types in Intensional Logic, is the smallest set such that:

(i) $e, t \in \mathbf{T}$;

(ii) If $a, b \in \mathbf{T}$, then $\langle a, b\rangle \in \mathbf{T}$;

(iii) If $a \in \mathbf{T}$, then $\langle s, a\rangle \in \mathbf{T}$;

For every type a let a set of constants $\mathbf{C}_a$ and a set of variables $\mathbf{V}_a$ be given, which may vary between dialects of Intensional Logic. Then the well-formed expressions of type a, $\mathbf{L}_a$, are the following:

A.2. Definition. **Expressions of Intensional Logic:**

a. If $\alpha \in \mathbf{V}_a$ or $\alpha \in \mathbf{C}_a$, then $\alpha \in \mathbf{L}_a$.

b. If $\alpha \in \mathbf{L}_{\langle a,b\rangle}$ and $\beta \in \mathbf{L}_a$, then $(\alpha(\beta)) \in \mathbf{L}_b$.

c. If $\varphi, \psi \in \mathbf{L}_t$, then $\neg\varphi, (\varphi \wedge \psi), (\varphi \vee \psi), (\varphi \rightarrow \psi), (\varphi \leftrightarrow \psi) \in \mathbf{L}_t$.

d. If $\varphi \in \mathbf{L}_t$ and $v \in \mathbf{V}_b$, then $\forall v\varphi$, $\exists v\varphi \in \mathbf{L}_t$.

e. If $\alpha, \beta \in \mathbf{L}_a$, then $(\alpha = \beta) \in \mathbf{L}_t$.

f. If $\alpha \in \mathbf{V}_a$ and $v \in \mathbf{V}_b$, then $\lambda v\alpha \in \mathbf{L}_{\langle b,a\rangle}$.

g. If $\alpha \in \mathbf{L}_a$, then $^\wedge\alpha \in \mathbf{L}_{\langle s,a\rangle}$.

h. If $\alpha \in \mathbf{L}_{\langle s,a\rangle}$, then $^\vee\alpha \in \mathbf{L}_a$.

i. For any a, every element of $\mathbf{L}_a$ is constructed in a finite number of steps using (a)-(h).

Following common practice, I will distinguish variables and constants for the most common types typographically and/or, in some cases, by using different parts of the alphabet (and I will use apostrophes where a set of variables falls short, e.g., $\mathcal{A}'$ and $\mathcal{A}''$), as in the following table. The "varying" and "mixed" types (bottom rows) will be clarified further below.

Type	Variables	Constants	Usage
e	x, y, z	$j, m, b, \ldots$	individual
t, $\langle e,t\rangle$, $\langle e,\langle e,t\rangle\rangle, \ldots$		$P, Q, R, \ldots$	n-ary first-order predicate (properties, relations)
$\langle s,t\rangle$	$\boldsymbol{p}, \boldsymbol{q}, \boldsymbol{r}$	$\boldsymbol{p}_0, \boldsymbol{p}_1, \ldots$	proposition, informational intent
	$\boldsymbol{a}, \boldsymbol{b}, \boldsymbol{c}$		state of affairs
$\langle\langle s,t\rangle,t\rangle$	$\mathcal{T}$	$\mathcal{T}_0, \mathcal{T}_1, \ldots$	theme
	$\mathcal{A}$	$\mathcal{A}_0, \mathcal{A}_1, \ldots$	attentional intent
		$\mathcal{I}$	set of informational intents
$\langle\langle\langle s,t\rangle,t\rangle,t\rangle$		$\mathscr{T}$	set of themes
		$\mathscr{A}$	set of attentional intents
(varying)	$\mathbb{p}$	$\mathbb{p}_0, \mathbb{p}_1, \ldots$	informational content
(mixed)		$\mathbb{I}$	set of informational contents
(mixed)	$\mathbb{A}$	$\mathbb{A}_0, \mathbb{A}_1, \ldots$	attentional content
(mixed)		$\mathbb{A}$	set of attentional contents

2 Model-theoretic semantics

Expressions are interpreted relative to a model $\mathbf{M}$ and an assignment function g that assigns to variables of a certain type entities of the same type. Models were introduced in chapter 2 (definition 2.3). A model contains a domain of individuals D and a set of possible worlds W, along with accessibility relations R_s and R_a and an interpretation function I. Expressions of different types are interpreted on domains constructed from the basic sets D and W as given in definition A.3: expressions of type e refer to entities in D, expressions of type t to truth values, and expressions of composite types to functions between the relevant sets.

A.3. Definition.
Given a model $\mathbf{M} = \langle D, W, R_s, R_a, I\rangle$, and for any types a, b, let:

(i) $\mathbf{D}_e = D$;

(ii) $\mathbf{D}_t = \{0, 1\}$;

(iii) $\mathbf{D}_{\langle a,b\rangle} = \mathbf{D}_b^{\mathbf{D}_a}$;

(iv) $\mathbf{D}_{\langle s,a\rangle} = \mathbf{D}_a^W$.

The interpretation function I of a model assigns to each atomic expression of the language an appropriate *intension*, that is, a function from possible worlds to objects in the appropriate domain. For instance, for an atomic expression α of type a, say, the name "John", $I(\alpha)$ returns a function that assigns to every world in W an object in $\mathbf{D}_a$, say, John in the actual world and his brother Bill in some other world (a hypothetical world in which John and Bill's parents for some reason gave them each other's names). Applying this function to a world, i.e., $I(\alpha)(w)$, returns the appropriate entity in $\mathbf{D}_a$.

Let $[\![\alpha]\!]_{\mathbf{M},w,g}$ be the *extension* of an expression α in a world w in the model $\mathbf{M}$, relative to an assignment function g. It is defined recursively as follows:

A.4. Definition. **Interpretation (extensions):**

a. If $\alpha \in \mathbf{C}_a$, then $[\![\alpha]\!]_{\mathbf{M},w,g} = I(\alpha)(w)$.
If $\alpha \in \mathbf{V}_a$, then $[\![\alpha]\!]_{\mathbf{M},w,g} = g(\alpha)$.

b. If $\alpha \in \mathbf{L}_{\langle a,b\rangle}$ and $\beta \in \mathbf{L}_a$, then $[\![\alpha(\beta)]\!]_{\mathbf{M},w,g} = [\![\alpha]\!]_{\mathbf{M},w,g}([\![\beta]\!]_{\mathbf{M},w,g})$.

c. If $\varphi, \psi \in \mathbf{L}_t$, then:
$[\![\neg\varphi]\!]_{\mathbf{M},w,g} = 1$ iff $[\![\varphi]\!]_{\mathbf{M},w,g} = 0$;
$[\![\varphi \wedge \psi]\!]_{\mathbf{M},w,g} = 1$ iff $[\![\varphi]\!]_{\mathbf{M},w,g} = 1$ and $[\![\psi]\!]_{\mathbf{M},w,g} = 1$;
$[\![\varphi \vee \psi]\!]_{\mathbf{M},w,g} = 1$ iff $[\![\varphi]\!]_{\mathbf{M},w,g} = 1$ or $[\![\psi]\!]_{\mathbf{M},w,g} = 1$;
$[\![\varphi \rightarrow \psi]\!]_{\mathbf{M},w,g} = 1$ iff $[\![\varphi]\!]_{\mathbf{M},w,g} = 0$ or $[\![\psi]\!]_{\mathbf{M},w,g} = 1$; and
$[\![\varphi \leftrightarrow \psi]\!]_{\mathbf{M},w,g} = 1$ iff $[\![\varphi]\!]_{\mathbf{M},w,g} = [\![\psi]\!]_{\mathbf{M},w,g}$.

d. If $\varphi \in \mathbf{L}_t$ and $v \in \mathbf{V}_a$, then:
$[\![\forall v\varphi]\!]_{\mathbf{M},w,g} = 1$ iff for all $d \in \mathbf{D}_a : [\![\varphi]\!]_{\mathbf{M},w,g[d/v]}$; and
$[\![\exists v\varphi]\!]_{\mathbf{M},w,g} = 1$ iff for some $d \in \mathbf{D}_a : [\![\varphi]\!]_{\mathbf{M},w,g[d/v]}$;
where $g[d/v]$ is g minimally modified such that it assigns d to v.

e. If $\alpha, \beta \in \mathbf{L}_a$, then $[\![\alpha = \beta]\!]_{\mathbf{M},w,g} = 1$ iff $[\![\alpha]\!]_{\mathbf{M},w,g} = [\![\beta]\!]_{\mathbf{M},w,g}$.

f. If $\varphi \in \mathbf{L}_t$, then:
$[\![\Box\varphi]\!]_{\mathbf{M},w,g} = 1$ iff for all $w' \in W$ such that wR_sw': $[\![\varphi]\!]_{\mathbf{M},w',g} = 1$;
$[\![\Diamond\varphi]\!]_{\mathbf{M},w,g} = 1$ iff for some $w' \in W$ such that wR_sw': $[\![\varphi]\!]_{\mathbf{M},w',g} = 1$.

g. If $\varphi \in \mathbf{L}_t$, then:
$[\![\boxdot\varphi]\!]_{\mathbf{M},w,g} = 1$ iff for all $w' \in W$ s.t. $\langle w, w'\rangle \in (R_s \cup R_a)^*$: $[\![\varphi]\!]_{\mathbf{M},w',g} = 1$;
$[\![\diamondsuit\varphi]\!]_{\mathbf{M},w,g} = 1$ iff for some $w' \in W$ s.t. $\langle w, w'\rangle \in (R_s \cup R_a)^*$: $[\![\varphi]\!]_{\mathbf{M},w',g} = 1$;
where $(.)^*$ returns the reflexive transitive closure of a relation.

h. If $\alpha \in \mathbf{V}_a$ and $v \in \mathbf{V}_b$, then $[\![\lambda v\alpha]\!]_{\mathbf{M},w,g}$ is that function $f \in \mathbf{D}_a^{\mathbf{D}_b}$ such that for all $d \in \mathbf{D}_b$: $f(d) = [\![\alpha]\!]_{\mathbf{M},w,g[d/v]}$.

i. If $\alpha \in \mathbf{L}_a$, then $[\![\hat{}\alpha]\!]_{\mathbf{M},w,g}$ is that function $f \in \mathbf{D}_a^W$ such that for all $w' \in W$: $f(w') = [\![\alpha]\!]_{\mathbf{M},w',g}$.

j. If $\alpha \in \mathbf{L}_{\langle s,a\rangle}$, then $[\![\check{}\alpha]\!]_{\mathbf{M},w,g} = [\![\alpha]\!]_{\mathbf{M},w,g}(w)$.

Lastly, in terms of the extension of a formula, truth and validity on a model are defined as follows:

A.5. Definition. **Truth/validity:**
For any expression φ of type t, and a model $\mathbf{M}$ with worlds W:

- $\mathbf{M}, w, g \models \varphi$ iff $[\![\varphi]\!]_{\mathbf{M},w,g} = 1$;
- $\mathbf{M}, w \models \varphi$ iff $\mathbf{M}, w, g \models \varphi$ for arbitrary g;
- $\mathbf{M} \models \varphi$ iff $\mathbf{M}, w \models \varphi$ for arbitrary $w \in W$.

3 Notational shorthands

Following common practice, I will often omit parentheses where this will not result in ambiguity, including the parentheses around the arguments of a predicate, e.g., I will write Pj instead of $P(j)$. A less common notation convention is the following: for all unary, first-order predicate constants P, I may write Pjm to mean $Pj \wedge Pm$, i.e., $P(j) \wedge P(m)$. For the sake of explicitness:

A.6. Definition. For all $P \in \mathbf{C}_{\langle e,t\rangle}$ and terms $\alpha_1, \ldots, \alpha_n \in \mathbf{C}_e$, let:
$P\alpha_1 \ldots \alpha_n \stackrel{\text{def}}{=} (P(\alpha_1) \wedge \ldots \wedge P(\alpha_n))$

While intended as a mere notation convention, one could also regard jm as denoting the *group* of j and m, and regard P as a *distributive* predicate – a distributive predicate applied to a group applies to all members of that group.

A more substantial notation convention is the following. It will occasionally be convenient to conceive of functions to truth values (type $\langle a, t\rangle$) as sets of things of type a, and to use the usual set-theoretical operations and relations within the object language. Most of these can be defined purely syntactically, as notational shorthands. They work as one would expect, i.e., in analogy to their metalanguage counterparts, but I include their definition for the sake of completeness:

A

A.7. Definition. **Set-theoretical notation (1/2):**
For $a \neq s$, $\alpha_i \in \mathbf{L}_a$ and $v \in \mathbf{V}_a$, and sets $\sigma, \tau \in \mathbf{L}_{\langle a,t\rangle}$, let:

a. $\{\alpha_1, \ldots, \alpha_n\} \stackrel{\text{def}}{=} \lambda v(v = \alpha_1 \vee \ldots \vee v = \alpha_n)$;
$(\alpha_1 \in \sigma) \stackrel{\text{def}}{=} \sigma(\alpha_1)$.

b. $(\sigma \subseteq \tau) \stackrel{\text{def}}{=} \forall v(\sigma(v) \rightarrow \tau(v))$; (for $\subset$, simply add $\sigma \neq \tau$)
$(\sigma \cap \tau) \stackrel{\text{def}}{=} \lambda v(\sigma(v) \wedge \tau(v))$;
$(\sigma \cup \tau) \stackrel{\text{def}}{=} \lambda v(\sigma(v) \vee \tau(v))$;
$\overline{\sigma} \stackrel{\text{def}}{=} \lambda v(\neg\sigma(v))$.

For $a \neq s$, $x \in \mathbf{V}_a$ and $y \in \mathbf{V}_{\langle a,t\rangle}$, and a set of sets $\sigma \in \mathbf{L}_{\langle\langle a,t\rangle,t\rangle}$:

c. $\bigcap\sigma \stackrel{\text{def}}{=} \lambda x \forall y(\sigma(y) \rightarrow y(x))$;
$\bigcup\sigma \stackrel{\text{def}}{=} \lambda x \exists y(\sigma(y) \wedge y())$.
For a set of sets $\sigma \in \mathbf{L}_{\langle\langle a,t\rangle,t\rangle}$, where type a may also be s,
now using $x \in \mathbf{V}_{\langle a,t\rangle}$ and $y \in \mathbf{V}_{\langle\langle a,t\rangle,t\rangle}$:
d. $\sigma^{\cap} \stackrel{\text{def}}{=} \lambda x(\exists y(y \subseteq \sigma \wedge x = \bigcap y))$. (Closure under intersection.)

This does not quite suffice: clauses a. b. and c. (and d. relies on c.) do not apply to intensional types, such as propositions. This is a consequence of the fact that Intensional Logic does not allow explicit reference to possible worlds. The following definition adds set-theoretical notation for intensional types:

A.8. Definition. **Set-theoretical notation (2/2):**
For propositions $p_i, p_j \in \mathbf{L}_{\langle s,t\rangle}$, using $q, r \in \mathbf{V}_{\langle s,t\rangle}$:
e. $(p_i \subseteq p_j) \stackrel{\text{def}}{=} (\lambda q \lambda r^{\wedge}({}^{\vee}q \rightarrow {}^{\vee}r)(p_i)(p_j)) = {}^{\wedge}\top$; (for $\subset$, add $p_i \neq p_j$)
$(p_i \cap p_j) \stackrel{\text{def}}{=} \lambda q \lambda r^{\wedge}({}^{\vee}q \wedge {}^{\vee}r)(p_i)(p_j)$;
$(p_i \cup p_j) \stackrel{\text{def}}{=} \lambda q \lambda r^{\wedge}({}^{\vee}q \vee {}^{\vee}r)(p_i)(p_j)$;
$\overline{p_i} \stackrel{\text{def}}{=} \lambda q^{\wedge}(\neg{}^{\vee}q)(p_i)$.
And for a set of propositions $\mathcal{A}_i \in \mathbf{L}_{\langle\langle s,t\rangle,t\rangle}$, with $a \in \mathbf{V}_{\langle s,t\rangle}$ and $\mathcal{A} \in \mathbf{V}_{\langle\langle s,t\rangle,t\rangle}$:
f. $\bigcap\mathcal{A}_i \stackrel{\text{def}}{=} \lambda\mathcal{A}^{\wedge}\forall a(\mathcal{A}(a) \rightarrow {}^{\vee}a)(\mathcal{A}_i)$;
$\bigcup\mathcal{A}_i \stackrel{\text{def}}{=} \lambda\mathcal{A}^{\wedge}\exists a(\mathcal{A}(a) \wedge {}^{\vee}a)(\mathcal{A}_i)$.

Here the way in which Intensional Logic hides the underlying quantification and abstraction over possible worlds works against us – but it is achieved, with a bit of hacking, following Zimmermann 1989.

4 "Varying" and "mixed" types

In the table given earlier, the constants and variables that I use to refer to (sets of) informational and attentional contents are of "varying" and "mixed" types, a matter which I will briefly explain. The constants and variables that refer to informational contents have to be of various types, because informational contents need not be complete propositions – sentences may express incomplete propositions, in which case the gap between content and intent (a complete proposition) is bridged by impliciture (chapter 4). The constants and variables that refer to attentional contents must be permitted to denote "mixed" sets, containing objects of various types, because by uttering a sentence one may draw attention to lots of different things (chapter 6 defined the attentional content as the set of informational contents of all constituents in the sentence). Similarly, the set of all informational contents of an utterance (denoted by $\mathbb{I}$) can be mixed, and the set of all attentional contents ($\mathbb{A}$) is a set of mixed sets.

Strictly speaking, such varying and mixed types, or *type polymorphism*, do not belong in a strictly typed language like IL. For the purposes of this dissertation the handling of "mixed" and "varying" types can remain implicit. After all, semantic contents do not play an important role in this dissertation, and the maxim of Manner, which links contents to the rest of the theory, is not fully formalized. However, future iterations of the framework/theory will have to deal with this, at least once the maxim of Manner is formalized and a proper semantic theory plugged in.

Appendix B

Proofs

2.10. Fact. For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (4):

$\mathbf{M}, w_0 \models$ I-Relation$(p_0, \mathcal{T}_0)$

Proof. For an arbitrary utterance model $\langle \mathbf{M}, w_0 \rangle$, given the assumptions in the example, we have:

$\mathbf{M}, w_0 \models \mathcal{T}_0 = \{^Pj, ^Pm, ^Pb, ^Pjm, ^Pjb, ^Pmb, ^Pjmb\}$

$\mathbf{M}, w_0 \models p_0 = ^Pjm$

And since the proposition denoted by p_0 in the actual world is contained in the set denoted by $\mathcal{T}_0$ in the actual world, we have:

$\mathbf{M}, w_0 \models \mathcal{T}_0(p_0)$

where the latter is equivalent, in all pragmatic models, to I-Relation$(p_0, \mathcal{T}_0)$.

2.15. Fact. For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (4):

$\mathbf{M}, w_0 \models$ I-Quantity$(p_0, \mathcal{T}_0) \rightarrow \neg\Box Pb$

Proof. Continuing the foregoing proof, note that we also have:

$\mathbf{M}, w_0 \models$ I-Relation$(^Pb, \mathcal{T}_0)$

Now, suppose that we have:

$\mathbf{M}, w_0 \models$ I-Quantity$(p_0, \mathcal{T}_0)$ (a)

Which in all pragmatic models is equivalent to:

$$\mathbf{M}, w_0 \models \forall q \left(\begin{pmatrix} \text{I-Quality}(q) \wedge \\ \text{I-Relation}(q, \mathcal{T}_0) \end{pmatrix} \rightarrow (p_0 \subseteq q) \right)$$

Now, suppose (to obtain a contradiction) that we have:

$\mathbf{M}, w_0 \models \Box Pb$ (b)

where the latter is equivalent, in all pragmatic models, to I-Quality(^Pb). But then, since ^Pb complies with both I-Quality and I-Relation, it follows from I-Quantity that:

$\mathbf{M}, w_0 \models p_0 \subseteq ^Pb$

which is not the case (given that $p_0 = {}^{\wedge}Pj$, and given that an utterance model must be sufficiently large to distinguish ${}^{\wedge}Pj$ from ${}^{\wedge}Pb$). Hence, retracting our supposition (b), it must be the case that:

$$\mathbf{M}, w_0 \models \neg\Box Pb$$

and retracting an earlier supposition (a), we conclude:

$$\mathbf{M}, w_0 \models \text{I-Quantity}(p_0, \mathcal{T}_0) \rightarrow \neg\Box Pb$$

2.16. Fact. For all normal pragmatic models $\mathbf{M}$ and any constant p_i:

$$\mathbf{M} \models \Box\,\text{I-Quality}(p_i) \leftrightarrow \text{I-Quality}(p_i)$$

And if thematic competence holds, for any constant $\mathcal{T}_j$:

$$\mathbf{M} \models \Box\,\text{I-Relation}(p_i, \mathcal{T}_j) \leftrightarrow \text{I-Relation}(p_i, \mathcal{T}_j)$$
$$\mathbf{M} \models \Box\,\text{I-Quantity}(p_i, \mathcal{T}_j) \leftrightarrow \text{I-Quantity}(p_i, \mathcal{T}_j)$$

Proof. With regard to I-Quality, in any normal pragmatic model $\mathbf{M}$, I-Quality(p_i) is equivalent to $\Box^{\vee}p_i$, hence we must prove:

$$\mathbf{M} \models \Box\Box^{\vee}p_i \leftrightarrow \Box^{\vee}p_i$$

The right-to-left direction follows from positive introspection (4); the left-to-right direction follows from negative introspection (5) and consistency (D).

As for I-Relation, take an arbitrary world w. Given thematic competence, the interpretation of $\mathcal{T}_j$ in w is the same as in any world w' that is belief-accessible from w. Given intent introspection, the same holds for p_i, and hence for the complex expression $\mathcal{T}_j(p_i)$, which is equivalent to I-Relation$(p_i, \mathcal{T}_j)$: the interpretation of this expression is the same in w as in any world w' belief-accessible from w, and therefore it is true in w if and only if it is true in all belief-accessible worlds w'. And since w was chosen arbitrarily, this holds throughout the model:

$$\mathbf{M} \models \Box\,\text{I-Relation}(p_i, \mathcal{T}_j) \leftrightarrow \text{I-Relation}(p_i, \mathcal{T}_j)$$

The analogous result for I-Quantity follows from the foregoing: given that the interpretations of p_i, $\mathcal{T}_j$, I-Quality(p_i) and I-Relation$(p_i, \mathcal{T}_j)$, are the same in a given world w as in all belief-accessible worlds, and given that the other expressions used in the definition of I-Quantity are rigid (e.g., the variable q), we have:

$$\mathbf{M} \models \Box\,\text{I-Quantity}(p_i, \mathcal{T}_j) \leftrightarrow \text{I-Quantity}(p_i, \mathcal{T}_j)$$

2.17. Fact. For any normal pragmatic model $\mathbf{M}$ and theme constant $\mathcal{T}_i$:

$$\mathbf{M} \models \forall p \forall q \left(\left(\begin{array}{c} \Box\,\text{I-Maxims}(p, \mathcal{T}_i) \wedge \\ \Box\,\text{I-Maxims}(q, \mathcal{T}_i) \end{array} \right) \rightarrow (p = q) \right)$$

And this holds also without the modal boxes ($\Box$).

Proof. First without the modal boxes. Take an arbitrary normal pragmatic model m and world w. Suppose that, relative to some assignment function g:

$$\mathbf{M}, w, g \models \text{I-Maxims}(p, \mathcal{T}_i) \wedge \text{I-Maxims}(q, \mathcal{T}_i)$$

For p to comply with I-Quantity, given that q complies with both I-Quality and I-Relation, the following must hold:

$$\mathbf{M}, w, g \models p \subseteq q$$

Analogousy, for q to comply with I-Quantity, given that p complies with both I-Quality and I-Relation, the following must hold:

$$\mathbf{M}, w, g \models q \subseteq p$$

It follows that if indeed both propositions comply with the I-maxims, the two must be equivalent, i.e., $p = q$.

Now with the modal boxes. Take an arbitrary normal pragmatic model $\mathbf{M}$ and world w. Suppose that, relative to some assignment function g:

$$\mathbf{M}, w, g \models \Box\,\text{I-Maxims}(p, \mathcal{T}_i) \wedge \Box\,\text{I-Maxims}(q, \mathcal{T}_i)$$

This means that in all worlds w' that are belief-accessible from w, we have:

$$\mathbf{M}, w', g \models \text{I-Maxims}(p, \mathcal{T}_i) \wedge \text{I-Maxims}(q, \mathcal{T}_i)$$

and hence, as shown above, in each belief-accessible world we have $p = q$. Since these are variables, their interpretation is the same in all worlds, hence we also have:

$$\mathbf{M}, w, g \models q \subseteq p$$

(If they had not been variables but constants, this could have been concluded anyway, via intent introspection.) Hence, if two propositions are taken to comply with the I-maxims, the two must be equivalent.

3.5. Fact. For all normal pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (9b) that validate thematic competence:

$$\mathbf{M}, w_0 \models \neg\,\text{A-Quality}(\mathcal{A}_0) \vee \neg\,\text{A-Parsimony}(\mathcal{A}_0, \mathcal{T}_0)$$

Proof. Take an arbitrary normal pragmatic utterance model $\langle \mathbf{M}, w_0 \rangle$ for (9b) that validates thematic competence. In such a model:

$$\mathbf{M}, w_0 \models \Box(Pjm \rightarrow Pb)$$
$$\mathbf{M}, w_0 \models \mathcal{T}_0 = \{{}^\wedge Pj, {}^\wedge Pm, {}^\wedge Pb\}^\cap$$
$$\mathbf{M}, w_0 \models \mathcal{A}_0 = \{{}^\wedge Pj, {}^\wedge Pjm, {}^\wedge Pjmb\}$$

Let us suppose, to obtain a contradiction, that both A-Quality and A-Parsimony are complied with:

$$\mathbf{M}, w_0 \models \text{A-Quality}(\mathcal{A}_0) \qquad (\text{i.e., } \forall a(\mathcal{A}(a) \rightarrow \Diamond {}^\vee a)) \tag{a}$$

$$\mathbf{M}, w_0 \models \text{A-Parsimony}(\mathcal{A}_0, \mathcal{T}_0) \qquad \text{that is:} \tag{b}$$

$$\mathbf{M}, w_0 \models \forall a \left(\begin{array}{c} (\mathcal{A}_0(a) \wedge \text{A-Quality}(\{a\})) \rightarrow \\ \Diamond \left({}^\vee a \wedge \forall b \left(\left(\begin{array}{c} b \subset a \wedge \\ \text{A-Relation}(\{b\}, \mathcal{T}_0) \end{array} \right) \rightarrow \neg {}^\vee b \right) \right) \end{array} \right)$$

We must show that this leads to a contradiction. Relative to an assignment function g that assigns the state of affairs denoted by $^\wedge Pjm$ to the variable $\mathfrak{a}$, the conditions of A-Parsimony are satisfied:

$$\mathbf{M}, w_0, g \models \mathcal{A}_0(\mathfrak{a})$$
$$\mathbf{M}, w_0, g \models \text{A-Quality}(\{\mathfrak{a}\}) \qquad \text{(by supposition (a))}$$

But we can show that the consequent of A-Parsimony is nevertheless false. To that end, take an arbitrary world w, that is belief-accessible from w_0, where the state of affairs assigned to $\mathfrak{a}$ (i.e., $^\wedge Pjm$) obtains:

$$\mathbf{M}, w, g \models {}^\vee\mathfrak{a} \tag{c}$$

Now, the following can be proven:

$$\mathbf{M}, w, g \models \neg\forall\mathfrak{b}\left(\left(\begin{array}{c}\mathfrak{b} \subset \mathfrak{a} \wedge \\ \text{A-Relation}(\{\mathfrak{b}\}, \mathcal{T}_0)\end{array}\right) \rightarrow \neg{}^\vee\mathfrak{b}\right) \qquad \text{that is:}$$
$$\mathbf{M}, w, g \models \exists\mathfrak{b}\left(\left(\begin{array}{c}\mathfrak{b} \subset \mathfrak{a} \wedge \\ \text{A-Relation}(\{\mathfrak{b}\}, \mathcal{T}_0)\end{array}\right) \wedge {}^\vee\mathfrak{b}\right)$$

After all, the state of affairs denoted by $^\wedge Pjmb$ could be assigned to $\mathfrak{b}$: it is more specific than $^\wedge Pjm$, and thematic in w_0 and hence in w (thematic competence), and since $^\wedge Pjm$ is true in w, $^\wedge Pb$ and hence $^\wedge Pjmb$ is true as well (because we assumed $\Box(Pjm \rightarrow Pb)$ in w_0). For this reason, A-Parsimony cannot in fact be complied with, contrary to supposition (b). Hence either supposition (a) or supposition (b) must be given up.

3.6. Fact. For all normal pragmatic models $\mathbf{M}$ and any constant $\mathcal{A}_i$:

$$\mathbf{M} \models \Box\,\text{A-Quality}(\mathcal{A}_i) \leftrightarrow \text{A-Quality}(\mathcal{A}_i)$$

And if thematic competence holds, for any constant $\mathcal{T}_j$:

$$\mathbf{M} \models \Box\,\text{A-Relation}(\mathcal{A}_i, \mathcal{T}_j) \leftrightarrow \text{A-Relation}(\mathcal{A}_i, \mathcal{T}_j)$$
$$\mathbf{M} \models \Box\,\text{A-Quantity}(\mathcal{A}_i, \mathcal{T}_j) \leftrightarrow \text{A-Quantity}(\mathcal{A}_i, \mathcal{T}_j)$$
$$\mathbf{M} \models \Box\,\text{A-Parsimony}(\mathcal{A}_i, \mathcal{T}_j) \leftrightarrow \text{A-Parsimony}(\mathcal{A}_i, \mathcal{T}_j)$$

Proof. For A-Quality, this follows from negative introspection (due to which for any φ it holds that $\Diamond\varphi \leftrightarrow \Box\Diamond\varphi$) combined with an instance of the K-axiom, $\Box\forall x\varphi \leftrightarrow \forall x\Box\varphi$, to get the box across the universal quantifier.

For A-Relation (like I-Relation) the analogous result follows from thematic competence and intent introspection, due to which $\mathcal{A}_0$ and $\mathcal{T}_0$, and hence A-Relation$(\mathcal{A}_0, \mathcal{T}_0)$, have the same interpretation in any world as in all its belief-accessible worlds. Similarly for A-Parsimony and A-Quantity, all sub-expressions of which receive the same interpretation everywhere (e.g., variables) or at least in all belief-accessible worlds.

3.7. Fact. For any normal pragmatic model $\mathbf{M}$, and any theme constant $\mathcal{T}_i$:

$$\mathbf{M} \models \forall\mathcal{A}\forall\mathcal{B}\left(\left(\begin{array}{l}\Box\,\text{A-Maxims}(\mathcal{A},\mathcal{T}_i)\wedge\\ \Box\,\text{A-Maxims}(\mathcal{B},\mathcal{T}_i)\end{array}\right)\rightarrow(\mathcal{A}=\mathcal{B})\right)$$

And this holds also without the modal boxes.

Proof. I will prove the fact only without the modal boxes. Take an arbitrary normal pragmatic model $\mathbf{M}$ and world w. Suppose that, relative to some assignment function g:

$$\mathbf{M}, w, g \models \text{A-Maxims}(\mathcal{A},\mathcal{T}_i)\wedge\text{A-Maxims}(\mathcal{B},\mathcal{T}_i)$$

If $\mathcal{B}$ complies with A-Quality, A-Relation and A-Parsimony, then so do all its singleton subsets. But then, for $\mathcal{A}$ to comply with A-Quantity, it must contain all those singleton subsets, and hence:

$$\mathbf{M}, w, g \models \mathcal{B}\subseteq\mathcal{A}$$

And conversely:

$$\mathbf{M}, w, g \models \mathcal{A}\subseteq\mathcal{B}$$

It follows that if indeed both attentional intents comply with the A-maxims, the two must be equivalent, i.e., $\mathcal{A}=\mathcal{B}$. The same holds also with the modal boxes, analogously to fact 2.17 above.

3.8. Fact.

- For all normal, pragmatic utterance models $\langle\mathbf{M}, w_0\rangle$ for (8b) that validate thematic competence:

  $$\mathbf{M}, w_0 \models \Box\,\text{A-Quantity}(\mathcal{A}_0,\mathcal{T}_0)\rightarrow(\Box\neg Pb\wedge\Box\neg Pm)$$

- For all normal, pragmatic utterance models $\langle\mathbf{M}, w_0\rangle$ for (8c) that validate thematic competence:

  $$\mathbf{M}, w_0 \models \Box\,\text{A-Quantity}(\mathcal{A}_0,\mathcal{T}_0)\rightarrow(\Box\neg Pb\wedge\Box(Pm\rightarrow Pjm))$$

  And there exists such a model where:

  $$\mathbf{M}, w_0 \not\models \Box\,\text{A-Quantity}(\mathcal{A}_0,\mathcal{T}_0)\rightarrow\Box\neg Pm$$

  Instead, for all normal pragmatic utterance models we have:

  $$\mathbf{M}, w_0 \models \Box\,\text{A-Quality}(\mathcal{A}_0)\rightarrow\neg\Box\neg Pm$$

Proof. First for (8b). Take an arbitrary normal pragmatic utterance model $\langle\mathbf{M}, w_0\rangle$ for (8b). The following is assumed:

$$\mathbf{M}, w_0 \models \mathcal{T}_0 = \{{}^\wedge Pj, {}^\wedge Pm, {}^\wedge Pb\}^\cap$$

$$\mathbf{M}, w_0 \models \mathcal{A}_0 = \{{}^\wedge Pj\}$$

And given thematic competence, we can make use of compliance introspection for A-Quantity (fact 3.6 above), i.e., $\Box\,\text{A-Quantity}(\mathcal{A}_0,\mathcal{T}_0)\leftrightarrow\text{A-Quantity}(\mathcal{A}_0,\mathcal{T}_0)$.

Suppose that A-Quantity is complied with, i.e.:

$$\mathbf{M}, w_0 \models \text{A-Quantity}(\mathcal{A}_0, \mathcal{T}_0) \qquad \text{that is: (a)}$$

$$\mathbf{M}, w_0 \models \forall a \left(\left(\begin{array}{c} \text{A-Quality}(\{a\}) \wedge \\ \text{A-Relation}(\{a\}, \mathcal{T}_0) \wedge \\ \text{A-Parsimony}(\{a\}, \mathcal{T}_0) \end{array} \right) \rightarrow \mathcal{A}_0(a) \right)$$

I will prove that $\Box\neg Pb$; the proof for $\Box\neg Pm$ is analogous.

Take an arbitrary assignment function g that assigns Bill's presence to a. Since no attention is drawn to Bill's presence, the consequent of A-Quantity ($\mathcal{A}_0(a)$) is false, hence the antecedent cannot be true either, i.e.:

$$\mathbf{M}, w_0, g \models \neg \left(\begin{array}{c} \text{A-Quality}(\{a\}) \wedge \\ \text{A-Relation}(\{a\}, \mathcal{T}_0) \wedge \\ \text{A-Parsimony}(\{a\}, \mathcal{T}_0) \end{array} \right)$$

Hence, at least one of these conjuncts must be false. A-Relation cannot be blamed, for Bill's presence is thematic, so it must be either A-Quality or A-Parsimony. Suppose, in order to obtain a contradiction, that A-Parsimony is to blame, i.e.:

$$\mathbf{M}, w_0, g \models \neg\, \text{A-Parsimony}(\{a\}, \mathcal{T}_0) \qquad \text{that is: (b)}$$

$$\mathbf{M}, w_0, g \models \neg\forall a' \left(\begin{array}{l} (a' \in \{a\} \wedge \text{A-Quality}(\{a'\})) \rightarrow \\ \qquad \Diamond \left({}^{\vee}a' \wedge \forall b \left(\left(\begin{array}{c} b \subset a' \wedge \\ \text{A-Relation}(\{b\}, \mathcal{T}_0) \end{array} \right) \rightarrow \neg\, {}^{\vee}b \right) \right) \end{array} \right)$$

And this can be simplified by noting that $a' \in \{a\}$ means that $a' = a$ and by moving the outer negation all the way inward (replacing operators by their duals), and even further by spelling out A-Quality and A-Relation:

$$\mathbf{M}, w_0, g \models \text{A-Quality}(a) \wedge \Box \left({}^{\vee}a \rightarrow \exists b \left(\left(\begin{array}{c} b \subset a \wedge \\ \text{A-Relation}(\{b\}, \mathcal{T}_0) \end{array} \right) \wedge {}^{\vee}b \right) \right), \text{ i.e.:}$$

$$\mathbf{M}, w_0, g \models \Diamond\, {}^{\vee}a \wedge \Box({}^{\vee}a \rightarrow \exists b\, (b \subset a \wedge \mathcal{T}_0(b) \wedge {}^{\vee}b))$$

For the second conjunct to be true, there must, in all worlds w' that are belief-accessible from w_0, be a true thematic state of affairs that is more specific than a, i.e., than ${}^{\wedge}Pb$. Since thematic competence holds, the theme $\mathcal{T}_0$ is the same in all belief worlds as in the actual world, hence such more specific states of affairs can only be either ${}^{\wedge}Pbm$, ${}^{\wedge}Pbj$ or ${}^{\wedge}Pjmb$. This means that at least one of these must be considered possible as well, and (because the theme is finite) one of these must be considered possible independently of any more specific thematic state of affairs. But in that case supposition (a) above, i.e., compliance with A-Quantity, entails that at least one of theses states of affairs must be included in the attentional intent, which is not the case: contradiction! We are forced to retract supposition (b), i.e., that drawing attention to Bill's presence would have violated A-Parsimony, and this leaves only A-Quality to blame:

$$\mathbf{M}, w_0, g \models \neg\, \text{A-Quality}(\{a\}) \qquad \text{that is, } \neg\Diamond Pb, \text{ and hence } \Box\neg Pb$$

And this is the desired exhaustivity implication. An analogous proof can be given with regard to Mary's presence, i.e., $\Box\neg Pm$.

As for (8c), the following is the case in an arbitrary normal pragmatic utterance model $\langle \mathbf{M}, w_0 \rangle$ for (8c):

$\mathbf{M}, w_0 \models \mathcal{T}_0 = \{^\wedge Pj, ^\wedge Pm, ^\wedge Pb\}^\cap$

$\mathbf{M}, w_0 \models \mathcal{A}_0 = \{^\wedge Pj, ^\wedge Pjm\}$

The proof for the exhaustivity implication with regard to Bill, i.e., $\Box\neg Pb$, is analogous to the foregoing proof with regard to (8b). As for Mary's presence, the crucial difference in (8c) is that a supposition analogous to supposition (b) above now *doesn't* lead to a contradiction, because there *is* a more specific state of affairs in the attentional intent, namely $^\wedge Pjm$. Hence, all we may conclude is that drawing attention to Mary's presence would have violated A-Quality *or* A-Parsimony, i.e.:

$\mathbf{M}, w_0 \models \Box\neg Pm \vee \Box(Pm \rightarrow Pjm)$ which is equivalent simply to $\Box(Pm \rightarrow Pjm)$

Recall that this result depends on supposition (a) above, i.e., compliance with A-Quantity.

Lastly, it is worth noting that compliance with A-Quantity is not incompatible with unconditional type of exhaustivity, i.e., $\Box\neg Pm$ – it just does not entail it (as a suitable countermodel can show). The stronger type of exhaustivity is ruled out, rather, by compliance with A-Quality:

$\mathbf{M}, w_0 \models \text{A-Quality}(\mathcal{A}_0) \rightarrow \Diamond Pjm$

After all, the consequent implies $\Diamond Pm$, which is equivalent to $\neg\Box\neg Pm$.

3.9. Fact. For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (11) that validate thematic competence:

$\mathbf{M}, w_0 \models \Box\,\text{A-Quantity}(\mathcal{A}_0, \mathcal{T}_0) \rightarrow \Box(Pm \rightarrow Pjmb)$

However, there exists a model $\langle \mathbf{M}, w_0 \rangle$ of that sort such that:

$\mathbf{M}, w_0 \not\models \Box\,\text{I-Quality}(p_0) \rightarrow \Box(Pm \rightarrow Pjmb)$

And likewise for Bill's presence ($\Box Pb \rightarrow Pjmb$).

Proof. The proof for the first result is analogous to the proof for fact 3.8 above, regarding (8c); substitute Pjm (or Pjb) for Pm, and substitute $Pjmb$ for Pjm.

The second result, an invalidity, is proven as follows. $\Box$ I-Quality(p_0) is equivalent, in all normal pragmatic utterance models for (11), to $\Box^\vee{}^\wedge Pj$, i.e., $\Box Pj$, and this is does not imply $\Box(Pm \rightarrow Pjmb)$ (or $\Box(Pb \rightarrow Pjmb)$). A suitable countermodel is such that $\Box Pj$ is true in the actual world, as well as either $\Box Pm$ or $\Box Pb$ but not both.

3.11. THEOREM. For all normal pragmatic models $\mathbf{M}$, for arbitrary constants $\mathcal{A}_i$ and $\mathcal{T}_j$, where the set of potentially thematic states of affairs is chain-complete:

$$\mathbf{M} \models \Box\,\text{A-QUANTITY}(\mathcal{A}_i, \mathcal{T}_j) \rightarrow \forall a \left(\begin{array}{l} (\Diamond \mathcal{T}_j(a) \wedge \neg \mathcal{A}_i(a)) \rightarrow \\ \quad \Box(\neg^{\vee} a \vee \exists b(\mathcal{A}_i(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)$$

If $\mathbf{M}$ in addition satisfies thematic competence, then:

$$\mathbf{M} \models \Box\,\text{A-QUANTITY}(\mathcal{A}_i, \mathcal{T}_j) \rightarrow \forall a \left(\begin{array}{l} (\mathcal{T}_j(a) \wedge \neg \mathcal{A}_i(a)) \rightarrow \\ \quad \Box(\neg^{\vee} a \vee \exists b(\mathcal{A}_i(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)$$

And if $\mathbf{M}$ in addition satisfies factivity, then:

$$\mathbf{M} \models \Box\,\text{A-QUANTITY}(\mathcal{A}_i, \mathcal{T}_j) \rightarrow \forall a \left(\begin{array}{l} (\mathcal{T}_j(a) \wedge \neg \mathcal{A}_i(a)) \rightarrow \\ \quad (\neg^{\vee} a \vee \exists b(\mathcal{A}_i(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)$$

Proof. The set of potentially thematic states of affairs is chain-complete if, and only if, for every chain of increasingly specific, potentially thematic states of affairs $a_0, a_1, \ldots$ (i.e., such that every $a_{i+1} \subset a_i$), their infinitary intersection $\bigcap\{a_0, a_1, \ldots\}$ is also potentially thematic. (Any finite set, for instance, is automatically chain-complete.) The role of this restriction will become clear later on.

Take an arbitrary normal pragmatic model $\mathbf{M}$ in which $\mathcal{T}_j$ complies with the chain completeness restriction. Take an arbitrary world w in this model. Suppose that the speaker takes A-Quantity to be complied with:

$$\mathbf{M}, w \models \Box\,\text{A-QUANTITY}(\mathcal{A}_i, \mathcal{T}_j) \tag{a}$$

This means that in all worlds w' that are belief-accessible from w:

$$\mathbf{M}, w' \models \forall a \left(\left(\begin{array}{c} \text{A-QUALITY}(\{a\}) \wedge \\ \text{A-RELATION}(\{a\}, \mathcal{T}_j) \wedge \\ \text{A-PARSIMONY}(\{a\}, \mathcal{T}_j) \end{array} \right) \rightarrow \mathcal{A}_i(a) \right)$$

Take an arbitrary assignment function g that assigns to a a state of affairs that is potentially thematic, i.e., suppose that:

$$\mathbf{M}, w, g \models \Diamond \mathcal{T}_j(a) \tag{b}$$

Hence, there exists a world that is belief-accessible from w in which $\mathcal{T}_j(a)$ is true. Let us call this world w'. Hence:

$$\mathbf{M}, w', g \models \mathcal{T}_j(a)$$

Suppose, furthermore, that no attention is drawn to a in w, and hence, by intent introspection, also in w':

$$\mathbf{M}, w, g \models \neg \mathcal{A}_i(a) \qquad \text{and likewise in } w' \tag{c}$$

Since $\mathcal{A}_i(a)$ is false in w', which is the consequent of A-Quantity, by supposition (a) the antecedent cannot be true either, i.e.:

$$\mathbf{M}, w', g \models \neg \left(\begin{array}{c} \text{A-QUALITY}(\{a\}) \wedge \\ \text{A-RELATION}(\{a\}, \mathcal{T}_0) \wedge \\ \text{A-PARSIMONY}(\{a\}, \mathcal{T}_0) \end{array} \right)$$

Hence, at least one of these conjuncts must be false. A-Relation cannot be blamed, because the state of affairs denoted by $\boldsymbol{a}$ is thematic in w' (from supposition (b)), so it must be either A-Quality or A-Parsimony. Let us explore the consequences of the latter.

Suppose that the singleton intent denoted by $\{\boldsymbol{a}\}$ does not comply with A-Parsimony in w':

$$\mathbf{M}, w', g \models \neg \text{A-PARSIMONY}(\{\boldsymbol{a}\}, \mathcal{T}_0) \tag{d}$$

In the proof above for fact 3.8 we saw that this amounts to the following:

$$\mathbf{M}, w', g \models \Diamond^{\vee}\boldsymbol{a} \wedge \Box(\Diamond^{\vee}\boldsymbol{a} \rightarrow \exists \boldsymbol{b}\,(\boldsymbol{b} \subset \boldsymbol{a} \wedge \mathcal{T}_0(\boldsymbol{b}) \wedge {}^{\vee}\boldsymbol{b}))$$

It follows that there exists a world w'' that is belief-accessible from w', such that the state of affairs assigned to $\boldsymbol{a}$ is true in w'', and, by the second conjunct, some stronger state of affairs can be assigned to $\boldsymbol{b}$ that is true and thematic in w''. This means that in w', the state of affairs assigned to $\boldsymbol{b}$ must be considered possible, and through negative introspection that it must be considered possible in all worlds belief-accessible from there, including w''. Hence, we have:

$$\mathbf{M}, w'', g \models \exists \boldsymbol{b}(\boldsymbol{b} \subset \boldsymbol{a} \wedge \mathcal{T}_0(\boldsymbol{b}) \wedge \Diamond^{\vee}\boldsymbol{b})$$

Moreover, since A-Quantity is believed to be complied with in w (supposition (a)), and since the accessibility relation is transitive (positive introspection), A-Quantity must be complied with in w''. Since this stronger state of affairs assigned to $\boldsymbol{b}$ is thematic and possible, A-Quantity requires that it be an element of the attentional intent denoted by $\mathcal{A}_i$ in w'' (and hence in any belief world and the original world w) unless A-Parsimony prevents this, i.e., unless there is an even more specific, potentially thematic and possible state of affairs (say, $\boldsymbol{c}$), independently of which $\boldsymbol{b}$ is not considered possible. And so on, potentially *ad infinitum*.

Since the set of potentially thematic states of affairs is *chain-complete*, this will not go on forever: there exists a maximally specific potentially thematic and possible state of affairs, and according to A-Quantity that must be an element of the attentional intent denoted by $\mathcal{A}_i$. This means that we can strengthen the result given earlier (right after supposition (d)) by adding $\mathcal{A}_i(\boldsymbol{b})$, which after dropping the conjunct $\mathcal{T}_0(\boldsymbol{b})$ yields the following:

$$\mathbf{M}, w', g \models \Diamond^{\vee}\boldsymbol{a} \wedge \Box(\Diamond^{\vee}\boldsymbol{a} \rightarrow \exists \boldsymbol{b}\,(\boldsymbol{b} \subset \boldsymbol{a} \wedge \mathcal{A}_i(\boldsymbol{b}) \wedge {}^{\vee}\boldsymbol{b}))$$

This was derived, recall, from the supposition that the singleton intent denoted by $\{\boldsymbol{a}\}$ does not comply with A-Parsimony in w', i.e., that A-Parsimony is the reason why the state of affairs assigned to $\boldsymbol{a}$ is not an element of the attentional intent denoted by $\mathcal{A}_i$. The other possible reason was A-Quality, i.e., $\neg\Diamond^{\vee}\boldsymbol{a}$. Hence, retracting supposition (d), we conclude:

$$\mathbf{M}, w', g \models \neg\Diamond^{\vee}\boldsymbol{a} \vee (\Diamond^{\vee}\boldsymbol{a} \wedge \Box(\Diamond^{\vee}\boldsymbol{a} \rightarrow \exists \boldsymbol{b}\,(\boldsymbol{b} \subset \boldsymbol{a} \wedge \mathcal{A}_i(\boldsymbol{b}) \wedge {}^{\vee}\boldsymbol{b})))$$

Through positive and negative introspection, the same holds in the original world w, from which w' is belief-accessible. Moreover, in the second disjunct, the first conjunct is redundant. Hence:

$$\mathbf{M}, w, g \models \neg\Diamond^{\vee}\boldsymbol{a} \vee \Box(\Diamond^{\vee}\boldsymbol{a} \rightarrow \exists \boldsymbol{b}\,(\boldsymbol{b} \subset \boldsymbol{a} \wedge \mathcal{A}_i(\boldsymbol{b}) \wedge {}^{\vee}\boldsymbol{b}))\text{, and this implies:}$$

$$\mathbf{M}, w, g \models \Box(\neg^{\vee}\boldsymbol{a} \vee \exists \boldsymbol{b}\,(\boldsymbol{b} \subset \boldsymbol{a} \wedge \mathcal{A}_i(\boldsymbol{b}) \wedge {}^{\vee}\boldsymbol{b}))$$

This was derived from suppositions (b) and (c), i.e., that the state of affairs assigned to

a is potentially thematic and not an element of the attentional intent. Retracting these suppositions, we obtain:

$$\mathbf{M}, w \models \forall a \left(\begin{array}{l} (\Diamond \mathcal{T}_j(a) \wedge \neg \mathcal{A}_i(a)) \rightarrow \\ \qquad \Box(\neg^{\vee} a \vee \exists b(\mathcal{A}_i(b) \wedge b \subset a \wedge {}^{\vee} b)) \end{array} \right)$$

And by retracting supposition (a), i.e., that A-Quantity is believed to be complied with, we obtain the first result in the theorem.

For the second result in the theorem, suppose that thematic competence holds in $\mathbf{M}$, i.e., that $\mathcal{T}_j$ receives the same interpretation in any given world as in its belief-accessible worlds. It follows that $\Diamond \mathcal{T}_j(a)$ is equivalent to $\mathcal{T}_j(a)$ in any world, and this substitution turns the first result of the theorem into the second.

For the third result, suppose that both thematic competence and factivity (the knowledge axiom "3") hold in $\mathbf{M}$. Then the modal box in the consequent of the second result can be omitted, yielding the third result.

3.13. Fact. For arbitrary constants or variables $\mathcal{A}$ and $\mathcal{T}$:

$$[\![\textsc{Exh}(\mathcal{A}, \mathcal{T})]\!] = \bigcap_{\substack{a \in [\![\mathcal{T}]\!] \\ a \notin [\![\mathcal{A}]\!]}} (\overline{a} \cup \bigcup_{\substack{b \in [\![\mathcal{A}]\!] \\ b \subset a}} b)$$

(Parameters $\mathbf{M}, w, g$ for $[\![.]\!]$, omitted for readability, are the same throughout.)

Proof. Recall that the operator is defined as follows:

$$\textsc{Exh}(\mathcal{A}, \mathcal{T}) \stackrel{\text{def}}{=} \lambda \mathcal{T}' \left(\lambda \mathcal{A}' \, {}^{\wedge} \forall a \left(\begin{array}{l} (\mathcal{T}'(a) \wedge \neg \mathcal{A}'(a)) \rightarrow \\ \qquad (\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right) (\mathcal{A}) \right) (\mathcal{T})$$

Let us simply compute the interpretation step by step:

$$[\![\lambda \mathcal{T}' \left(\lambda \mathcal{A}' \, {}^{\wedge} \forall a \left(\begin{array}{l} (\mathcal{T}'(a) \wedge \neg \mathcal{A}'(a)) \rightarrow \\ \qquad (\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right) (\mathcal{A}) \right) (\mathcal{T})]\!]_{\mathbf{M},w,g}$$

$$= [\![{}^{\wedge} \forall a \left(\begin{array}{l} (\mathcal{T}'(a) \wedge \neg \mathcal{A}'(a)) \rightarrow \\ \qquad (\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)]\!]_{\mathbf{M},w,g[[\![\mathcal{T}]\!]_{\mathbf{M},w,g}/\mathcal{T}'][[\![\mathcal{A}]\!]_{\mathbf{M},w,g}/\mathcal{A}']}$$

For readability let $g[[\![\mathcal{T}]\!]_{\mathbf{M},w,g}/\mathcal{T}'][[\![\mathcal{A}]\!]_{\mathbf{M},w,g}/\mathcal{A}'] = h$. So we get:

$$[\![{}^{\wedge} \forall a \left(\begin{array}{l} (\mathcal{T}'(a) \wedge \neg \mathcal{A}'(a)) \rightarrow \\ \qquad (\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)]\!]_{\mathbf{M},w,g'}$$

$$= \{w' \mid [\![\forall a \left(\begin{array}{l} (\mathcal{T}'(a) \wedge \neg \mathcal{A}'(a)) \rightarrow \\ \qquad (\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)) \end{array} \right)]\!]_{\mathbf{M},w',g'} = 1\}$$

$$= \{w' \mid \text{ for all } a \text{ s.t. } [\![\mathcal{T}'(a) \wedge \neg \mathcal{A}'(a)]\!]_{\mathbf{M},w',g'[a/a]}: \\ [\![\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)]\!]_{\mathbf{M},w',g'[a/a]} = 1\}$$

$$= \{w' \mid \text{ for all } a \text{ s.t. } a \in [\![\mathcal{T}]\!]_{\mathbf{M},w,g} \text{ and } a \notin [\![\mathcal{A}]\!]_{\mathbf{M},w,g}: \\ [\![\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)]\!]_{\mathbf{M},w',g'[a/a]} = 1\}$$

Unpacking the latter first yields:

$$\begin{aligned}
&[\![\neg^{\vee} a \vee \exists b(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)]\!]_{\mathbf{M},w',g'[a/a]} \\
&= w' \in \overline{a}, \text{ or for some } b\text{: } [\![(\mathcal{A}'(b) \wedge (b \subset a) \wedge {}^{\vee} b)]\!]_{\mathbf{M},w',g'[b/b][a/a]} = 1 \\
&= w' \in \overline{a}, \text{ or for some } b \text{ s.t. } b \in [\![\mathcal{A}]\!]_{\mathbf{M},w,g} \text{ and } b \subset a\text{: } w' \in b \\
&= w' \in \overline{a}, \text{ or } w' \in \bigcup_{\substack{b \in [\![\mathcal{A}]\!]_{\mathbf{M},w,g} \\ b \subset a}} b \\
&= w' \in \overline{a} \cup \bigcup_{\substack{b \in [\![\mathcal{A}]\!]_{\mathbf{M},w,g} \\ b \subset a}} b
\end{aligned}$$

And combining this with the prior result yields:

$$\begin{aligned}
&\{w' \mid \text{ for all } a \text{ s.t. } a \in [\![\mathcal{T}]\!]_{\mathbf{M},w,g} \text{ and } a \notin [\![\mathcal{A}]\!]_{\mathbf{M},w,g}\text{: } w' \in \overline{a} \cup \bigcup_{\substack{b \in [\![\mathcal{A}]\!]_{\mathbf{M},w,g} \\ b \subset a}} b\} \\
&= \bigcap_{\substack{a \in [\![\mathcal{T}]\!]_{\mathbf{M},w,g} \\ a \notin [\![\mathcal{A}]\!]_{\mathbf{M},w,g}}} (\overline{a} \cup \bigcup_{\substack{b \in [\![\mathcal{A}]\!]_{\mathbf{M},w,g} \\ b \subset a}} b)
\end{aligned}$$

And this concludes the proof.

3.17. Fact. Take any utterance with intents denoted by p_i and $\mathcal{A}_j$ such that $\mathcal{A}_j = \{p_i\}$ is true, and theme denoted by $\mathcal{T}_k$. For any normal, pragmatic, operational utterance model $\langle \mathbf{M}, w_0 \rangle$ for such an utterance:

$$\mathbf{M}, w_0 \models \textsc{Exh}_{\text{mw}}(p_i, \mathcal{T}_k) = p_i \cap \textsc{Exh}(\mathcal{A}_j, \mathcal{T}_k)$$

Proof. Let us first interpret the right-hand side of the equivalence, relying on fact 3.13 above, and again omitting the parameters $\mathbf{M}, w_0, g$ for the sake of readability:

$$\begin{aligned}
&[\![p_i \cap \textsc{Exh}(\{p_i\}, \mathcal{T}_k)]\!] \\
&= [\![p_i]\!] \cap [\![\textsc{Exh}(\{[\![p_i]\!]\}, [\![\mathcal{T}_k]\!])]\!] \\
&= [\![p_i]\!] \cap \bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \notin \{[\![p_i]\!]\}}} (\overline{a} \cup \bigcup_{\substack{b \in \{[\![p_i]\!]\} \\ b \subset a}} b) \\
&= [\![p_i]\!] \cap \bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \neq [\![p_i]\!]}} (\overline{a} \cup \bigcup_{\substack{b = [\![p_i]\!] \\ b \subset a}} b) \\
&= [\![p_i]\!] \cap (\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \supset [\![p_i]\!]}} (\overline{a} \cup \bigcup_{\substack{b = [\![p_i]\!] \\ b \subset a}} b)) \cap (\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \not\supset [\![p_i]\!]}} (\overline{a} \cup \bigcup_{\substack{b = [\![p_i]\!] \\ b \subset a}} b)) \\
&= [\![p_i]\!] \cap (\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \supset [\![p_i]\!]}} (\overline{a} \cup [\![p_i]\!])) \cap (\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \not\supset [\![p_i]\!]}} (\overline{a} \cup \top))
\end{aligned}$$

And continuing:

$$\begin{aligned}
&[\![p_i]\!] \cap \Big(\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \supset [\![p_i]\!]}} (\overline{a} \cup [\![p_i]\!]) \Big) \cap \Big(\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \not\supseteq [\![p_i]\!]}} (\overline{a} \cup \top) \Big) \\
= &[\![p_i]\!] \cap \Big(\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \supset [\![p_i]\!]}} [\![p_i]\!] \Big) \cap \Big(\bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \not\supseteq [\![p_i]\!]}} \overline{a} \Big) \\
= &[\![p_i]\!] \cap \bigcap_{\substack{a \in [\![\mathcal{T}_k]\!] \\ a \not\supseteq [\![p_i]\!]}} \overline{a}
\end{aligned}$$

That is, when the attentional intent is the singleton set denoted by $\{p_i\}$, the current exhaustivity operator simply excludes every thematic state of affairs that is not entailed by the proposition denoted by p_i. What results is a set of worlds in which the proposition denoted by p_i is true and no (other) thematic propositions are true except those that are entailed by the proposition denoted by p_i.

Depending on the theme, the set of worlds thus characterized may be empty (namely if there is a set of states of affairs that are not entailed by p_i but that together cover (a superset of) p_i – excluding each of those from p_i will yield the empty set). But the set is necessarily non-empty in any normal, pragmatic, operational utterance model for the relevant type of utterance, i.e.:

$$[\![p_i \cap \textsc{Exh}(\mathcal{A}_j, \mathcal{T}_k)]\!]_{\mathbf{M},w_0,g} \neq \emptyset$$

This holds because both $[\![p_i]\!]$ and $[\![\textsc{Exh}(\mathcal{A}_j, \mathcal{T}_k)]\!]$ must contain at least the actual world w_0: this follows, respectively, from compliance with I-Quality and factivity, and from compliance with A-Quantity, thematic competence and factivity.

Since the set is non-empty, the worlds it contains – i.e., in which the proposition denoted by p_i is true and no other thematic propositions except those that are entailed by the proposition denoted by p_i – will be the ones where the set of true thematic propositions is *minimized* as far as the truth of the proposition denoted by p_i allows. And these are exactly the worlds that $\textsc{Exh}_{\text{mw}}$ selects, according to definition 3.16.

3.19. Fact. Take any utterance with intents denoted by p_i and $\mathcal{A}_j$ and theme denoted by $\mathcal{T}_k$ such that the following is true:

- $p_i = \bigcup \mathcal{A}_j$;
- $\mathcal{T}_k = \mathcal{A}_j^{\cap}$; and
- $\forall a((\mathcal{T}_k(a) \wedge \neg \mathcal{A}_j(a)) \rightarrow \neg \exists b(b \subset a \wedge \mathcal{A}_j(b)))$.

For any normal, pragmatic, operational utterance model $\langle \mathbf{M}, w_0 \rangle$ for such an utterance:

$$\mathbf{M}, w_0 \models \textsc{Exh}_{\text{ie}}(\mathcal{A}_j) = (p_i \cap \textsc{Exh}(\mathcal{A}_j, \mathcal{T}_k))$$

Proof. According to the definition (again omitting the parameters $\mathbf{M}, w_0, g$):

$$[\![\textsc{Exh}_{\text{ie}}(\mathcal{A}_j)]\!] = \bigcup [\![\mathcal{A}_j]\!] \cap \bigcap_{a \in \text{IE}([\![\mathcal{A}_j]\!])} \overline{a}$$

Since, by assumption, $p_i = \bigcup \mathcal{A}_j$ is true in w_0, this means that:

$$[\![\textsc{Exh}_{\text{ie}}(\mathcal{A}_j)]\!] = [\![p_i]\!] \cap \bigcap_{a \in \text{IE}([\![\mathcal{A}_j]\!])} \overline{a}$$

And since in addition $\mathcal{T}_k = \mathcal{A}_j^{\cap}$ must be true, what we must prove is the following:

$$\bigcap_{a \in \text{IE}([\![\mathcal{A}_j]\!])} \overline{a} = [\![\textsc{Exh}(\mathcal{A}_j, \mathcal{A}_j^{\cap})]\!]$$

Let us compute the right-hand side according to fact 3.13, and then simplify it – for convenience I will do so as a chain of equations (or "continued equality"):

$$[\![\textsc{Exh}(\mathcal{A}_j, \mathcal{A}_j^{\cap})]\!] = \bigcap_{\substack{a \in [\![\mathcal{A}_j]\!]^{\cap} \\ a \notin [\![\mathcal{A}_j]\!]}} (\overline{a} \cup \bigcup_{\substack{b \in [\![\mathcal{A}_j]\!] \\ b \subset a}} b) = \bigcap_{\substack{a \in [\![\mathcal{A}_j]\!]^{\cap} \\ a \notin [\![\mathcal{A}_j]\!]}} (\overline{a} \cup \top) = \bigcap_{\substack{a \in [\![\mathcal{A}_j]\!]^{\cap} \\ a \notin [\![\mathcal{A}_j]\!]}} \overline{a}$$

The prefinal step is legitimate because, by the third assumption given in the fact, there is no state of affairs in the attentional intent that is more specific than one to which no attention is drawn (i.e., a). The result shows that, in this case, my operator simply excludes in its entirety every state of affairs that is thematic but not in the attentional intent. To prove the main equality we must show that:

$$\bigcap_{a \in \text{IE}([\![\mathcal{A}_j]\!])} \overline{a} = \bigcap_{\substack{a \in [\![\mathcal{A}_j]\!]^{\cap} \\ a \notin [\![\mathcal{A}_j]\!]}} \overline{a}$$

And this can be done by showing that:

(i) all innocently excludable states of affairs are thematic ones to which no attention is drawn.

(ii) all thematic states of affairs to which no attention is drawn are innocently excludable;

To prove (i), take an arbitrary state of affairs that is innocently excludable in w_0. From the definition of innocent exclusion it follows directly that it must be thematic in w_0. And since it must be consistently excludable from every state of affairs in the attentional intent, and since it cannot be consistently excluded from itself, it cannot itself be a state of affairs in the attentional intent.

To prove (ii) it is convenient to formulate certain parts in the object language. Assign to the variable $\boldsymbol{a}$ an arbitrary thematic state of affairs to which no attention is drawn ($\boldsymbol{a} \notin \mathcal{A}_j$, $\boldsymbol{a} \in \mathcal{T}_k$). To obtain a contradiction (and then conclude the contrary), suppose that it *isn't* innocently excludable. This means that some state of affairs can be assigned to $\boldsymbol{b}$ to which attention is drawn ($\boldsymbol{b} \in \mathcal{A}_j$), such that there is a way of excluding from it as many thematic states of affairs as consistency allows *without* excluding the state of affairs assigned to $\boldsymbol{a}$. Put differently, there must be some maximal set of thematic states of affairs that can be consistently excluded from the one assigned to $\boldsymbol{b}$, but not whilst also excluding the one assigned to $\boldsymbol{a}$. Suppose, without loss of generality, that this maximal state contains just one state of affairs, and let us assign it to $\boldsymbol{c}$. Summing up,

and more formally, what we suppose is that, for the relevant type of utterance model, there exists an assignment function g such that:

$\mathbf{M}, w_0, g \models \mathit{a} \in \mathcal{T}_k \wedge \mathit{a} \notin \mathcal{A}_j$

$\mathbf{M}, w_0, g \models \mathit{b} \in \mathcal{T}_k \wedge \mathit{b} \in \mathcal{A}_j \wedge (\mathit{b} \cap \overline{\mathit{a}} \neq \emptyset)$

$\mathbf{M}, w_0, g \models \mathit{c} \in \mathcal{T}_k \wedge (\mathit{b} \cap \overline{\mathit{c}} \neq \emptyset) \wedge (\mathit{b} \cap \overline{\mathit{c}} \cap \overline{\mathit{a}} = \emptyset)$

Now, given compliance with the maxims, we have:

$\mathbf{M}, w_0, g \models \Diamond^{\vee} \mathit{b}$ (A-Quality)

$\mathbf{M}, w_0, g \models \Box \neg^{\vee} \mathit{a}$ (A-Quantity, i.e., Exh)

Moreover, since the states of affairs assigned to a, b and c are all thematic, so are their intersections (by assumption, since $\mathcal{T}_k = \mathcal{A}_j^{\cap}$). Now, since $\mathit{b} \cap \overline{\mathit{c}} \cap \overline{\mathit{a}} = \emptyset$, we have that:

$\mathbf{M}, w_0, g \models \mathit{b} = (\mathit{b} \cap \mathit{a}) \cup (\mathit{b} \cap \mathit{c})$

Since the state of affairs assigned to a is not considered possible, the one denoted by $\mathit{b} \cap \mathit{a}$ is not possible either; and since the state of affairs assigned to b *is* possible, this can only be because the one denoted by $\mathit{b} \cap \mathit{c}$ is possible. This entails that the state of affairs assigned to b is not considered possible independently of the one denoted by $\mathit{b} \cap \mathit{c}$, i.e.:

$\mathbf{M}, w_0, g \models \neg \Diamond (^{\vee} \mathit{b} \wedge \neg^{\vee} (\mathit{b} \cap \mathit{c}))$

And since the intent denoted by $\mathcal{A}_j$ contains the state of affairs assigned to b (since $\mathit{b} \in \mathcal{A}_j$), the intent denoted by $\mathcal{A}_j$ cannot comply with A-Parsimony, contrary to assumption (that the utterance model is operational). Given this contradiction, we retract our supposition that the state of affairs assigned to a is not innocently excludable, and conclude that it must be.

In sum, in the restricted range of cases considered here, the states of affairs that are innocently excludable, and hence excluded by Exh_{ie}, correspond exactly to those excluded by the current exhaustivity operator Exh.

3.21. Fact. Take any utterance with intents denoted by p_i and $\mathcal{A}_j$ and a theme denoted by $\mathcal{T}_k$, and for which the following is true:

- $p_i = \bigcup \mathcal{A}_j$; and
- $\mathcal{T}_k = \mathcal{T}_k^{\cap}$.

For any normal, pragmatic, operational utterance model $\langle \mathbf{M}, w_0 \rangle$ for such an utterance:

$\mathbf{M}, w_0 \models \text{Exh}_{\text{dyn}}(\mathcal{A}_j, \mathcal{T}_k) = (p_i \cap \text{Exh}(\mathcal{A}_j, \mathcal{T}_k))$

Proof. We prove the equivalence by proving inclusion right-to-left and then left-to-right. First right-to-left: in an arbitrary utterance model $\langle \mathbf{M}, w_0 \rangle$ of the relevant sort, take a world $w \in [\![p_i \cap \text{Exh}(\mathcal{A}_j, \mathcal{T}_k)]\!]_{\mathbf{M}, w_0, g}$. Given that $p_i = \bigcup \mathcal{A}_j$ is true in w_0, there must be some $a \in [\![\mathcal{A}_j]\!]_{\mathbf{M}, w_0, g}$ such that $w \in a$. Moreover, given the chain-completeness restriction on themes in operational models, and given compliance with A-Relation,

there must be a most specific (strongest, smallest) a of that sort. From the exhaustivity operator it follows that every thematic state of affairs to which no attention is drawn is either false in w, or entailed by this most specific a. Hence, w makes the proposition a true and anything entailed by it, but no other thematic propositions. Within a, then, there is no $w' \in a$ where the set of true thematic propositions is smaller than in w. Hence (by definition) $w \in [\![\textsc{Exh}_{\text{dyn}}(\mathcal{A}_j, \mathcal{T}_k)]\!]_{\mathbf{M},w_0,g}$.

Conversely, take an arbitrary world $w \in [\![\textsc{Exh}_{\text{dyn}}(\mathcal{A}_j, \mathcal{T}_k)]\!]_{\mathbf{M},w_0,g}$. According to the definition of $\textsc{Exh}_{\text{dyn}}$, there must be some $a \in [\![\mathcal{A}_j]\!]_{\mathbf{M},w_0,g}$ such that $w \in a$ and w makes a minimal number of thematic propositions true, compared to other $w' \in a$. Given the chain-completeness restriction and compliance with A-Relation, there must be a most specific (strongest, smallest) a of that sort. Within this most specific a, any minimal set of true thematic propositions will contain a and anything entailed by it, but nothing else. (This is because, if a minimal set of true thematic propositions had contained another thematic proposition a', then the intersection $a \cap a'$ would have been thematic as well (by assumption of closure under intersection), and a would not have been possible independently of these more specific intersections, contrary to A-Parsimony, and would not have been included in the attentional intent.) Hence, this world w is contained in a, to which attention is drawn, but in no more specific thematic state of affairs. By definition, my operator contains all such worlds. Moreover, given that $p_i = \bigcup \mathcal{A}_j$ is true in w_0, we have that $w \in [\![p_i]\!]_{\mathbf{M},w_0,g}$, and hence $w \in [\![p_i \cap \textsc{Exh}(\mathcal{A}_j, \mathcal{T}_k)]\!]_{\mathbf{M},w_0,g}$.

6.3. Fact. For all normal pragmatic models $\mathbf{M}$ such that $\mathcal{T}_i$ denotes a theme that is closed under intersection:

$$\mathbf{M}, w_0 \models \forall p \forall \mathcal{A} \left(\left(\begin{array}{c} \textsc{I-maxims}(p, \mathcal{T}_i) \wedge \\ \textsc{A-maxims}(\mathcal{A}, \mathcal{T}_i) \end{array} \right) \rightarrow \left(p = \bigcup \mathcal{A} \right) \right)$$

Proof. Take an arbitrary normal pragmatic model $\mathbf{M}$ in which $\mathcal{T}_i$ denotes a theme closed under intersection. Take an arbitrary assignment function g and suppose that it assigns to p and $\mathcal{A}$ intents that comply with the maxims:

$$\mathbf{M}, g \models \textsc{I-maxims}(p, \mathcal{T}_i) \wedge \textsc{A-maxims}(\mathcal{A}, \mathcal{T}_i)$$

I will show that $p = \bigcup \mathcal{A}$ is true, by showing that neither $p \supset \bigcup \mathcal{A}$ nor $p \not\supseteq \bigcup \mathcal{A}$ is true.

Suppose (to obtain a contradiction) that $p \supset \bigcup \mathcal{A}$ is true. This means that no attention is drawn to the state of affairs assigned to p, i.e., $p \notin \mathcal{A}$. Since the state of affairs assigned to p is thematic and considered true (I-Relation, I-Quality), and hence thematic and considered possible, the reason (given compliance with A-Quantity) why no attention is drawn to it must be A-Parsimony, i.e., there must be a more specific thematic state of affairs independently of which p is not believed to be possible. That is, there exists an assignment function g' that differs from g only in the assignment to, say, a, such that:

$$\mathbf{M}, g' \models a \in \mathcal{T}_i \wedge a \subset p \wedge \Box({}^{\vee}p \rightarrow {}^{\vee}a)$$

But since the proposition denoted by p itself is believed to be true (I-Quality), so must the denotation of a. And since the latter is both thematic and believed to be true,

compliance of the proposition denoted by p with I-Quantity demands that $p \subseteq a$ is true, which is not the case. Contradiction.

Alternatively, suppose (again to obtain a contradiction) that $p \not\supseteq \bigcup \mathcal{A}$ is true. This means that attention is drawn to some state of affairs that is a superset of or logically independent of (properly overlaps) the proposition denoted by p. That is, there exists an assignment function g' that differs from g at most in, say, a, such that:

$$\mathbf{M}, g' \models a \in \mathcal{A} \wedge \neg(a \subseteq p)$$

Now, we know that the denotations of p and a are thematic (I-Relation and A-Relation, respectively), hence so is their intersection, i.e., $\mathcal{T}_i(p \cap a)$ is true. Moreover, since $\Box{}^{\vee}p$ is true (I-Quality), so is $\Box({}^{\vee}a \to {}^{\vee}(p \cap a))$, which means that the state of affairs denoted by a is not considered possible independently of its intersection with p. It follows that, by A-Parsimony, no attention ought to have been drawn to the state of affairs denoted by a. Contradiction.

In sum, neither $p \supset \bigcup \mathcal{A}$ nor $p \not\supseteq \bigcup \mathcal{A}$ is true. It follows that $p = \bigcup \mathcal{A}$ is true.

12.5. Fact. For all normal, pragmatic utterance models $\langle \mathbf{M}, w_0 \rangle$ for (14), assuming that $\mathcal{T}_0$ is chain-complete (cf. chapter 3):

$$\mathbf{M}, w_0 \models ({}^{\vee}p_4 \wedge \underbrace{(\Box\neg Pm \to \Box\neg\mathcal{T}_0({}^{\wedge}Pm))}_{\text{from the Reasonable Goal Principle}}) \to (\Box\neg\mathcal{T}_0({}^{\wedge}Pm))$$

Proof. For the relevant example, it was assumed that $\mathcal{A}_0 = \{{}^{\wedge}Pj\}$, $\mathcal{T}_0({}^{\wedge}Pj)$, No-I-Maxims($\mathcal{T}_0$), and $p_4 = {}^{\wedge}\Box$ Maxims($\mathcal{T}_0$). For an arbitrary normal, pragmatic utterance model $\langle \mathbf{M}, w_0 \rangle$ for this example, suppose that:

$$\mathbf{M}, w_0 \models {}^{\vee}p_4 \quad \text{i.e., } \mathbf{M}, w_0 \models \Box \text{ Maxims}(\mathcal{T}_0)$$

From this it follows in particular that $\Box$ A-Quantity($\mathcal{A}_0, \mathcal{T}_0$), and hence that Mary's presence, to which no attention is drawn, must be taken to violate either A-Quality, A-Relation or A-Parsimony. Since the theme is chain-complete and no attention is drawn to anything more specific, we can rule out A-Parsimony, and therefore:

$$\mathbf{M}, w_0 \models \Box\neg\mathcal{T}_0({}^{\wedge}Pm) \vee \Box\neg Pm$$

Now, suppose that:

$$\mathbf{M}, w_0 \models \Box\neg Pm \to \Box\neg\mathcal{T}_0({}^{\wedge}Pm)$$

This follows from the Reasonable Goal Principle and the assumption that the speaker was responsible for the theme: rational speakers do not set goals that they know will not be accomplished. Now, since either $\Box\neg Pm$ or $\Box\neg\mathcal{T}_0({}^{\wedge}Pm)$ (the previous formula), and since the former implies the latter, we can conclude the latter:

$$\mathbf{M}, w_0 \models \Box\neg\mathcal{T}_0({}^{\wedge}Pm)$$

Appendix C

The competence questionnaire

This appendix presents the results of a questionnaire aimed at falsifying the common hypothesis that exhaustivity implications would rely on a competence assumption (see chapter 3). The questionnaire is not intended as a proper empirical study, e.g., there is no control condition and the number of informants is small. In its defense, the hypothesis that it is meant to falsify has not to my awareness ever been argued to be plausible, i.e., it has not been explained why assuming each other's competence would be rational. Nor has any real evidence in its favor ever been presented; as I explained in chapter 3, purported evidence in its favor has in fact been misinterpreted. Furthermore, as I noted in chapter 3, accounts of exhaustivity based on I-Quantity and the competence assumption face several other serious problems. For these reasons I think that the energy required for a proper empirical investigation would be better spent on trying to falsify a more plausible theory, or on developing such a theory if none exists – and this dissertation has concentrated on the latter. The exploratory nature of this empirical investigation notwithstanding, I think that the results cannot be too easily dismissed.

Stimulus The questionnaire was setup online, in Google Forms. Ten self-proclaimed native Dutch participants took part, on a voluntary basis. They were first presented with the following instructions (here translated from Dutch):

> INSTRUCTIONS: This will take about 5 minutes. You will listen to a conversation and read a number of propositions. Indicate for each proposition whether it follows from the conversation (whether the conclusion is "justified"). You may listen to the conversation as often as you like, and you can also judge the propositions while listening. There are no right or wrong answers, and there's no snake in the grass, so don't think too hard – but don't be too sloppy either. Many thanks in advance for participating!
> ...

> It's a conversation between two students, and good friends, Ben and Kim, who are each mentor of a group of first graders. They have nothing to hide from each other.

Later they were reminded again that they were allowed to replay the conversation. A transcription of the conversation is given below (B = Ben, K = Kim), with the relevant intonational contours transcribed according to ToDI (Gussenhoven 2005; used in part II of this dissertation).

(1) B: Hee Kim! Deed jij mee met die fietstocht gisteren?
"Hey Kim! Did you take part in the bike ride yesterday?"

K: Nee, ik kon niet! Maar ik zag ze vanuit de verte, toen ik in de bus naar mijn ouders zat. Ze waren al een heel eind.
"No, I couldn't! But I saw them from afar, when I was on the bus to visit my parents. They had already covered quite some distance!"

B: Oh, dan weet je dit vast niet precies, maar wie van mijn mentorgroepje deden er allemaal mee?
"Oh, then you probably don't know exactly, but who of my tutor group took part?"

K: Lotte, Frank en Chris. "Lotte, Frank and Chris."
H*L % H*L % H*L L%

B: Ok. En van jouw mentorgroepje? "Okay. And of your tutor group?"

K: Carolien en Jan zoals gewoonlijk. "Carolien and Jan as usual."
H*L L%

B: Ok, bedankt! "Okay, thanks!"

I have underlined the two parts the serve to prevent a competence assumption – though not Kim's competence, which is still possible (and I explained in chapter 3 why that is crucial). The competence assumption is prevented both contextually, by virtue of Kim seeing the cyclists only from a distance, and explicitly, by Ben's disclaimer.

Experimental task The participants were asked to rate propositions on the following scale:

1. helemaal niet terecht "totally unjustified"
2. grotendeels onterecht "largely unjustified"
3. deels terecht, deels onterecht "part justified, part unjustified"
4. grotendeels terecht "largely justified"
5. volkomen terecht "totally justified"

The propositions to be rated were the following:

(2) a. Kim had graag mee willen doen met de fietstocht. [mean rating: 3.7]
"Kim would have liked to take part in the bike ride."

b. Het is mogelijk dat Kim niet elke meefietsende student heeft gezien en herkend. [2.9]
"It's possible that Kim didn't see and recognize every student who rode along."

c. Kim is ervan overtuigd dat er, van het mentorgroepje van Ben, precies drie mensen meefietsten. [4.2]
"Kim is convinced that, of Ben's mentor group, exactly three people rode along."

d. Lotte zit in Kim's mentorgroepje. [1.0]
"Lotte is a member of Kim's mentor group."

e. Van het mentorgroepje van Kim fietsten volgens haar alleen Carolien en Jan mee. [3.7]
"Of Kim's mentor group, according to her, only Carolien and Jan rode along."

f. Carolien doet meestal mee aan dergelijke studentenactiviteiten. [4.6]
"Carolien usually takes part in such student activities."

The crucial propositions are (b), (c) and (e): (b) denies the competence assumption (though not Kim's competence) while (c) and (e) assert exhaustivity. The other propositions are fillers that target non-essential bits of the conversation, one obviously false (d) and two possible/probable (a,f).

Results The numbers given above, next to the propositions in (2), are the mean ratings, rounded to one decimal. Ratings per participant are given in the table on the right. I excluded one participant (the last row) from the analysis, and from the mean ratings, who rated the obviously false proposition (d) as 5. Thus, the mean ratings shown are for the nine participants remaining.

a	b	c	d	e	f
3	4	4	1	4	5
4	5	4	1	4	4
4	5	5	1	3	5
3	2	4	1	4	4
2	1	5	1	4	4
4	1	5	1	5	5
4	2	4	1	3	4
4	1	5	1	5	5
5	5	2	1	1	5
3	3	3	5	3	3

Interpretation of the results The ratings seem to show that, in general, Kim's answers are interpreted exhaustively (propositions (c) and (e)) more often than not. Opinions about the competence assumption, proposition (b), are mixed, a result that may be explained as follows. The situation in which all three propositions (b), (c) and (e) are true is very unlikely at best: Kim would have potentially failed to see everyone whilst still being confident that she saw everyone from Ben's group and hers. Three participants (the first three rows) did not see or care about this near-contradiction, and rated all three (b), (c) and (e) as high (mostly 5). The behavior of this group shows most directly that exhaustivity implications occur without a competence assumption.

Five other participants may have spotted the near-contradiction, and rated (b) low (mostly 1) while still rating (c) and (e) as high (mostly 5 and mostly 4, respectively). The behavior of this group provides an even stronger case against the competence assumption: assuming that they did notice the obvious cues in

favor of proposition (a), the exhaustivity they inferred from B's responses despite this even forced them to reconsider. This explains the mixed ratings for (a).

One remaining participant (ninth row) behaved as approaches based on the competence assumption would predict: (s)he maintained proposition (b) (rated 5) at the cost of propositions (c) and (e), which were rated low (rated 2 and 1, respectively). This might point to the reliance of exhaustivity on a competence assumption for that one participant, but this is not the only possible explanation. For instance, one might expect at least some participants to judge propositions (c) and (e) as false on grounds of them not having been explicitly asserted, i.e., they might have reasoned: "well, although I would interpret it like that, Kim didn't explicitly say it...". Either way, the questionnaire results for the other participants strongly favor an account on which exhaustivity does not rely on a competence assumption.

Appendix D

Clashes of the A-maxims

This overview is more concise than the overview of clashes of the I-maxims given in chapter 8. It does not include Venn diagrams or linguistic examples. As in chapter 8, I will first give an overview of the ontic clashes, and then of the epistemic clashes.

1 Overview of ontic clashes

No individual clashes (except A-Clarity)

Relative to a given theme, every A-maxim on its own except A-Clarity, to be discussed separately below, can always be ontically complied with:

D.1. Fact. None of the A-maxims individually ever ontically clashes.

Formally, this means that for all normal pragmatic models such that $\mathcal{T}_i$ denotes a theme in every world (i.e., a non-empty set):

$\mathbf{M} \models \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Quality}(\mathcal{A}))$
$\mathbf{M} \models \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Relation}(\mathcal{A}, \mathcal{T}))$
$\mathbf{M} \models \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Quantity}(\mathcal{A}, \mathcal{T}))$
$\mathbf{M} \models \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Parsimony}(\mathcal{A}, \mathcal{T}))$

(That attentional intents must be non-empty was assumed in chapter 3, assumption 3.2.) A-Quality is complied with, for instance, by the set containing only a tautology. A-Relation is complied with by any subset of the theme. A-Quantity is complied with by any set containing at least everything that is thematic and possible – and if nothing is considered thematic and possible, then any arbitrary (non-empty) set will do. A-Parsimony is complied with by, for instance, the set containing the strongest thematic states of affairs considered possible – if these exist – or simply the strongest states of affairs considered possible, and even by the set containing just a contradiction.

No clashes involving A-Quantity

From the pointwise definition of the maxims it is apparent that A-Quantity will never be more demanding than the other maxims are permissive, i.e., A-Quantity demands only that attention be drawn to all states of affairs that ontically comply with the other maxims. Hence:

D.2. Fact. A-Quantity never ontically properly clashes with any (set of) maxim(s).

Formally, using A-Maxims′ as an ad hoc shorthand for any combination of A-maxims (minus A-Clarity), this means that for all normal pragmatic models $\mathbf{M}$ in which $\mathcal{T}_i$ denotes a theme (non-empty set):

$$\mathbf{M} \models \begin{pmatrix} \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Maxims}'(\mathcal{A}, \mathcal{T}_i)) \rightarrow \\ \quad \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Maxims}'(\mathcal{A}, \mathcal{T}_i) \wedge \text{A-Quantity}(\mathcal{A}, \mathcal{T}_i)) \end{pmatrix}$$

A-Relation/A-Quality clash

It may be that no state of affairs is both thematic and possible, hence:

D.3. Fact. A-Quality and A-Relation may ontically properly clash.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ where for some world w in which $\mathcal{T}_i$ denotes a nonempty set:

$$\mathbf{M}, w \models \begin{pmatrix} \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Quality}(\mathcal{A})) \wedge \\ \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Relation}(\mathcal{A}, \mathcal{T}_i)) \wedge \\ \neg\exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \text{A-Quality}(\mathcal{A}) \wedge \text{A-Relation}(\mathcal{A}, \mathcal{T}_i)) \end{pmatrix}$$

Note that in this case A-Quantity is trivially satisfied, i.e., it does not demand that attention be drawn to anything. A-Parsimony is trivially satisfied as well: because nothing thematic is considered possible, anything that is considered possible must be considered possible independently of anything thematic.

A-Relation/A-Parsimony clash

If a theme is not *chain-complete* (see chapter 3), then it may happen that a speaker considers all thematic states of affairs possible, but none independently of any more specific thematic states of affairs. In that case, there is no attentional intent that ontically complies with both A-Relation and A-Parsimony, hence:

D.4. Fact. A-Relation and A-Parsimony may ontically properly clash, but only relative to a theme that is not chain-complete.

(I will now omit what this means formally.) If a theme is not chain-complete, then it is not closed under (infinitary) intersection as far as the Reasonable Goal Principle allows, and as such the Reasonable Closure Principle will prevent this type of clash.

No A-Quality/A-Parsimony clash

D.5. Fact. A-Quality and A-Parsimony do not ontically clash.

For instance, take an attentional intent that contains any maximally specific (not necessarily thematic) state of affairs that the speaker considers possible.

Three-way clash (A-Relation/A-Parsimony/A-Quality)

No A-Relation/A-Parsimony clash occurs if some thematic states of affairs are not considered possible at all: these would vacuously satisfy A-Parsimony. However, A-Quality would prohibit that attention be drawn to such states of affairs, resulting in a three-way clash:

D.6. Fact. Relative to a theme that is not chain-complete, A-Relation, A-Parsimony and A-Quality may ontically properly clash.

Again, the Reasonable Closure Principle may prevent this type of clash.

Clashes involving A-Clarity

For A-Clarity I assume the same as for I-Clarity (chapter 8):

D.7. Assumption.

a. A-Clarity (and Content Efficacy) may clash on its own and with any (set of) A-maxims, but only in certain special circumstances (e.g., non-fluent speaker, background noise); and

b. A-Clarity (and Content Efficacy) may *temporarily* clash on its own, if the speaker cannot comply with it right away, in the course of a longer utterance.

These two types are analogous to those on the informational side, so for an explanation I refer to chapter 8. There I also explained that none of the I-maxims clash with any of the A-maxims, except perhaps clashes involving I/A-Clarity

No clashes involving Conciseness, Prominence Alignment

Also as on the informational side, I assume that the Conciseness and Prominence Alignment submaxims of Manner do not clash with the A-maxims:

D.8. Assumption. Conciseness and Prominence Alignment do not clash with any of the A-maxims.

Again, for motivation I refer to chapter 8.

Summary

The foregoing discussion exhausts the range of logically possible, proper ontic clashes involving the A-maxims, i.e.:

(i) A-Relation and A-Quality, if nothing thematic is taken to be possible;

(ii) A-Relation, A-Parsimony (and A-Quality) – only if the theme is not chain-complete;

(iii) A-Clarity (and Content Efficacy) on its own and with various maxims, if clear communication is compromised;

(iv) A-Clarity (and Content Efficacy) on its own, temporarily, within longer utterances.

2 Overview of epistemic clashes

No individual clashes except A-Relation (and A-Clarity)

D.9. Fact. A-Quality, A-Parsimony and A-Quantity do not epistemically clash on their own.

Formally, this means that for any normal pragmatic model $\mathbf{M}$, where $\mathcal{T}_i$ denotes a theme (a non-empty set) in every world:

$$\mathbf{M} \models \exists \mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box \text{ A-Quality}(\mathcal{A}))$$
$$\mathbf{M} \models \exists \mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box \text{ A-Quantity}(\mathcal{A}, \mathcal{T}_i))$$
$$\mathbf{M} \models \exists \mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box \text{ A-Parsimony}(\mathcal{A}, \mathcal{T}_i))$$

For A-Quality, take any intent that contains only states of affairs that the speaker considers possible (e.g., only a tautology); for A-Quantity, take any intent that contains at least all potentially thematic states of affairs that the speaker considers independently possible; for A-Parsimony take any set containing just something sufficiently strong, e.g., a contradiction.

A-Relation does epistemically clash on its own, namely if it is completely unclear what is thematic, i.e., if nothing is believed with certainty to be thematic:

D.10. Fact. A-Relation may epistemically properly clash, though only if thematic competence does not hold.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ and world w, in which $\mathcal{T}_i$ denotes a non-empty set, such that:

$$\mathbf{M}, w \models \neg\exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box\,\text{A-Relation}(\mathcal{A}, \mathcal{T}_i))$$

An epistemic A-Relation clash is always accompanied an epistemic I-Relation clash, and vice versa.

A-Quantity/A-Relation clash

Although A-Relation and A-Quantity can never ontically clash, they may epistemically clash, namely in case there is uncertainty about the theme. If thematic competence does not hold, epistemic compliance with A-Quantity may demand that attention be drawn also to merely potentially thematic states of affairs, which is more than epistemic compliance with A-Relation permits. Hence:

D.11. Fact. A-Relation and A-Quantity may epistemically properly clash, though only if thematic competence does not hold.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ and a world w, in which $\mathcal{T}_i$ denotes a non-empty set, such that:

$$\mathbf{M}, w \models \left(\begin{array}{c} \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box\,\text{A-Quantity}(\mathcal{A}, \mathcal{T}_i)) \wedge \\ \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box\,\text{A-Relation}(\mathcal{A}, \mathcal{T}_i)) \wedge \\ \neg\exists\mathcal{A}\left(\mathcal{A} \neq \emptyset \wedge \Box\left(\begin{array}{c}\text{A-Relation}(\mathcal{A}, \mathcal{T}_i) \wedge \\ \text{A-Quantity}(\mathcal{A}, \mathcal{T}_i)\end{array}\right)\right) \end{array}\right)$$

(Recall that the first conjunct is always true.)

If an analogous clash on the informational side, i.e., I-Quantity/I-Relation, is due solely to uncertainty about the theme, then it is always accompanied by an A-Quantity/A-Relation clash: if something is merely potentially thematic and considered true, it is also considered possible. The reverse does not hold: a merely potentially thematic state of affairs may be considered possible without there being any such state of affairs that is considered true. That is:

D.12. Fact. An epistemic proper I-Quantity/I-Relation clash that is due to uncertainty about the theme is always accompanied by an epistemic proper A-Quantity/A-Relation clash, but not necessarily vice versa.

A-Quantity/A-Parsimony clash

Although A-Parsimony and A-Quantity do not ontically clash, an epistemic clash may occur when drawing attention to something thematic and possible merely *potentially* violates A-Parsimony: epistemic compliance with A-Quantity will then require that attention be drawn to it – better safe than sorry, so to speak – while epistemic compliance with A-Parsimony does not permit this. Thus:

D.13. Fact. A-Parsimony and A-Quantity may epistemically properly clash, though only if thematic competence does not hold.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ and a world w, in which $\mathcal{T}_i$ denotes a non-empty set, such that:

$$\mathbf{M}, w \models \left(\begin{array}{c} \exists \mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box \text{ A-Quantity}(\mathcal{A}, \mathcal{T}_i)) \wedge \\ \exists \mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box \text{ A-Parsimony}(\mathcal{A}, \mathcal{T}_i)) \wedge \\ \neg \exists \mathcal{A} \left(\mathcal{A} \neq \emptyset \wedge \Box \left(\begin{array}{c} \text{A-Quantity}(\mathcal{A}, \mathcal{T}_i) \wedge \\ \text{A-Parsimony}(\mathcal{A}, \mathcal{T}_i) \end{array} \right) \right) \end{array} \right)$$

An A-Quantity/A-Parsimony clash is typically accompanied by an A-Quantity/A-Relation clash, namely:

D.14. Fact. Relative to a chain-complete theme, an epistemic proper A-Quantity/A-Parsimony clash is always accompanied by an epistemic proper A-Quantity/A-Relation clash.

After all, if there is a state of affairs s to which drawing attention merely potentially violates A-Parsimony, then there must be some more specific state of affairs s' that is considered possible and merely potentially thematic, independently of which s is not considered possible. And if there exists such a possible and potentially thematic state of affairs s', and the theme is chain-complete, A-Quantity will demand that attention be drawn to it (or to something more specific), whereas this is not permitted by A-Relation.

No A-Quantity/A-Quality clash

Epistemic compliance with A-Quantity will never require that attention be drawn to states of affairs that are not considered possible, hence:

D.15. Fact. A-Quality and A-Quantity do not epistemically clash.

Formally, this means that, for all normal pragmatic models $\mathbf{M}$ where $\mathcal{T}_i$ denotes a non-empty set in every world:

$$\mathbf{M} \models \exists \mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box(\text{A-Quality}(\mathcal{A}) \wedge \text{A-Quantity}(\mathcal{A}, \mathcal{T}_i)))$$

A-Relation/A-Quality clash

It is possible for there to be nothing that the speaker considers both thematic and possible, hence:

D.16. Fact. A-Quality and A-Relation may epistemically properly clash.

Formally, this means that there exists a normal pragmatic model $\mathbf{M}$ and world w, where $\mathcal{T}_i$ denotes a non-empty set, such that:

$$\mathbf{M}, w \models \begin{pmatrix} \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box\,\text{A-Quality}(\mathcal{A})) \wedge \\ \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box\,\text{A-Relation}(\mathcal{A}, \mathcal{T}_i)) \wedge \\ \neg\exists\mathcal{A}\left(\mathcal{A} \neq \emptyset \wedge \Box\left(\begin{matrix}\text{A-Quality}(\mathcal{A}) \wedge \\ \text{A-Relation}(\mathcal{A}, \mathcal{T}_i)\end{matrix}\right)\right) \end{pmatrix}$$

(Note that the first conjunct is always true.)

On the informational side, recall that I distinguished three types of epistemic I-Relation/I-Quality clashes: hopeless, truth-uncertain and theme-uncertain. Two of those exist also on the attentional side:

- **Hopeless:** The speaker is certain that nothing thematic is possible (an ontic A-Relation/A-Quality clash in every belief world);
- **Theme-uncertain:** there is a state of affairs that, according to the speaker, is possible, but only potentially thematic.

There is no truth-uncertain type of clash on the attentional side, because if the speaker is uncertain about the truth of some state of affairs that is believed to be thematic, then this state of affairs is considered thematic and possible, in which case there is no A-Relation/A-Quality clash.

A hopeless clash on the attentional side entails a hopeless clash on the informational side and vice versa (this situation is coped with, recall, by addressing a different theme, such as one evoked by the Pruning Principle). More generally, if there is an A-Relation/A-Quality clash, then there is also an I-Relation/I-Quality clash. The reverse does not hold, however. For one, a truth-uncertain clash on the informational side in fact excludes an A-Relation/A-Quality clash. More generally, if nothing that is taken to be thematic is considered true (i.e., an I-Relation/I-Quality clash), it can still be the case that something is considered both thematic and possible (i.e., no A-Relation/A-Quality clash). Hence:

D.17. Fact. If A-Relation and A-Quality epistemically properly clash, then so do I-Relation and I-Quality – but not necessarily vice versa.

As on the informational side, a theme-uncertain A-Relation/A-Quality clash is accompanied by an A-Relation/A-*Quantity* clash, but not necessarily vice versa.

A-Relation/A-Parsimony clash

A-Parsimony, recall, may ontically clash with A-Relation if the theme is not chain-complete. But the maxims may epistemically clash even relative to a theme that *is* theme-complete, namely if all states of affairs that are believed to be thematic are considered possible, but none of them is considered possible independently of something that is *potentially* thematic. Hence:

D.18. Fact. A-Relation and A-Parsimony may epistemically properly clash, even relative to a chain-complete theme, but then only if thematic competence doesn't hold.

I will now omit what this means formally.

If an A-Relation/A-Parsimony clash occurs that is due to uncertainty about the theme (i.e., not due to an ontic clash), then it is accompanied by clashes with A-Quantity: A-Parsimony/A-Quantity (discussed below) and A-Relation/A-Quantity. After all, for an A-Relation/A-Parsimony clash to occur relative to a chain-complete theme, there must be a state of affairs that is certainly thematic and potentially not independently possible, and another that is certainly independently possible but merely potentially thematic. Drawing attention to the one would potentially violate A-Parsimony and drawing attention to the other would potentially violate A-Relation, but A-Quantity would demand that attention be drawn to both – better safe than sorry, as it were. Hence:

D.19. Fact. An epistemic proper A-Relation/A-Parsimony clash that is due to uncertainty about the theme, is always accompanied by an epistemic proper A-Parsimony/A-Quantity clash and hence (by fact D.14) by an epistemic proper A-Relation/A-Quantity clash.

The reverse does not hold: A-Parsimony may clash with A-Quantity, and A-Relation with A-Quantity, without a simultaneous A-Parsimony/A-Relation clash. After all, A-Quantity can be more demanding than A-Relation or A-Parsimony permits even if there is a way to comply with A-Relation and A-Parsimony.

No A-Quality/A-Parsimony clash

Take the set containing any strongest (not necessarily thematic) state of affairs that one considers possible. This intent will epistemically comply with both A-Quality and A-Parsimony. Hence:

D.20. Fact. A-Quality and A-Parsimony do not epistemically clash.

A-Relation/A-Parsimony/A-Quality clash

Suppose that something is considered thematic and possible (complying with A-Relation and A-Quality), that something else is considered thematic and not possible (complying with A-Relation and, vacuously, with A-Parsimony), and that again something else is considered possible independently of anything stronger that is thematic (complying with A-Quality and A-Parsimony). In this case there is no two-way clash. Still, it may be the case that no state of affairs is considered thematic, possible, and independently possible. That is:

D.21. Fact. A-Relation, A-Parsimony and A-Quality together may epistemically properly clash, though relative to a chain-complete theme only if thematic competence does not hold.

Moreover, just like an A-Relation/A-Parsimony clash (fact D.19), an epistemic proper A-Relation/A-Parsimony/A-Quality clash that is due to uncertainty about the theme is always accompanied by an epistemic proper A-Parsimony/A-Quantity clash and hence (by fact D.14) by an epistemic proper A-Relation/A-Quantity clash.

No proper three-way or four-way clashes involving A-Quantity

From the pointwise nature of the definitions of the A-maxims it follows that, if epistemic compliance with A-Quantity is no more demanding than epistemic compliance with A-Quality permits, and no more demanding than epistemic compliance with A-Relation permits, then it cannot be more demanding than what both together permit, either. The same holds for combinations with A-Parsimony. Hence:

D.22. Fact. There are no epistemic proper three-way or four-way clashes involving A-Quantity.

Formally, using A-Maxims′ as an ad-hoc shorthand for any combination of A-maxims (minus A-Clarity), this means that for all normal pragmatic models $\mathbf{M}$ in which $\mathcal{T}_i$ denotes a theme (non-empty set):

$$\mathbf{M} \models \begin{pmatrix} \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box\,\text{A-Maxims}'(\mathcal{A}, \mathcal{T}_i)) \rightarrow \\ \quad \exists\mathcal{A}(\mathcal{A} \neq \emptyset \wedge \Box(\text{A-Maxims}'(\mathcal{A}, \mathcal{T}_i) \wedge \text{A-Quantity}(\mathcal{A}, \mathcal{T}_i))) \end{pmatrix}$$

Summary

In sum, relative to a chain-complete theme, the following clashes among the A-maxims (minus A-Clarity) may occur independently:

(i) A-Relation: if nothing is believed with certainty to be thematic;

(ii) A-Relation and A-Quality: if the speaker is certain that nothing thematic is true (hopeless), or is unsure which possible states of affairs are thematic (theme-uncertain).

(iii) A-Relation and A-Quantity: if the speaker is unsure how many independently possible states of affairs are thematic.

And the latter can be accompanied by an A-Relation/A-Parsimony clash, an A-Quantity/A-Parsimony clash, or a three-way A-Relation/A-Parsimony/A-Quality clash. If we consider also the non-formalized clashes of A-Clarity and Manner, then we get, in addition:

(iv) A-Clarity (and Content Efficacy) on its own and with various maxims, if clear communication is potentially compromised;

(v) A-Clarity (and Content Efficacy) on its own, temporarily, within longer utterances.

This concludes the overview.

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Summary

Exhaustivity and intonation: a unified theory

This dissertation presents a precise, unified and explanatory theory of human conversation, centered on two broad phenomena: exhaustivity implications and intonational meaning. In a nutshell: (i) speakers have two types of communicative intentions, namely information sharing and attention sharing, (ii) these types of intentions ideally comply with a certain set of rationality criteria, or maxims, (iii) speakers of English and related languages use intonation, in particular so-called trailing tones and boundary tones, to indicate whether such compliance is achieved, and (iv) exhaustivity implications arise when this holds, at least, for the attention-sharing intention.

The research presented here goes against a number of widespread assumptions in the field. The result is a perspective on conversation that enables new solutions to a broad range of well-known puzzles surrounding exhaustivity and intonation. Among these are the "symmetry problem", the "epistemic step" without a competence assumption, the role of informationally redundant disjuncts, the bias expressed by rising declaratives, the range of uses of rise-fall-rise intonation, the effects of different intonation contours in lists, and differences between questions with rising and falling intonation.

Samenvatting

Uitputtendheid en intonatie: een verenigde theorie

Dit proefschrift zet een precieze, unificerende en verklarende theorie uiteen van bepaalde opvallende patronen in menselijk communicatief gedrag. De behandelde patronen hebben alle te maken met twee meer algemene verschijnselen: zogeheten implicaties van uitputtendheid, waardoor een antwoord op een vraag als uitputtend kan worden geïnterpreteerd, en de betekenis van intonatie, in het bijzonder in talen zoals het Engels en het Nederlands. In een notendop: (i) sprekers hebben twee soorten communicatieve bedoelingen, namelijk het delen van informatie en het richten van de aandacht, (ii) deze bedoelingen dienen rationeel te zijn, dat wil zeggen, zo volledig en zeker mogelijk te voldoen aan een aantal eisen, of maximen, (iii) sprekers van talen zoals het Engels en het Nederlands benutten intonatie, met name bepaalde verschillen in toonhoogte, om aan te geven of hun communicatieve bedoelingen volgens hen aan deze maximen voldoen, en (iv) implicaties van uitputtendheid doen zich voor wanneer dit in het bijzonder geldt voor de bedoeling van het richten van de aandacht.

Dit proefschrift weerspreekt enkele binnen het vakgebied wijdverbreide aannames. Het resultaat is een perspectief op communicatief gedrag dat nieuwe oplossingen toelaat voor een breed scala aan bekende vraagstukken omtrent uitputtendheid en intonatie. Zo biedt de gepresenteerde theorie oplossingen voor onder meer het "symmetrieprobleem", de "epistemische sprong" zonder een aanname van competentie, de rol van disjuncten die wat informatie betreft redundant zijn, de suggestiviteit van bewerende zinnen met stijgende intonatie, het gebruik van een stijgend-dalend-stijgend intonatiepatroon, de effecten van intonatie in opsommingen, en verschillen tussen vraagzinnen met stijgende en dalende intonatie.

About the author

M. Westera was born on October 28, 1987 in 's-Hertogenbosch, The Netherlands. After obtaining his *Gymnasium* diploma from the Grotiuscollege in Heerlen he went to study Cognitive Artificial Intelligence at Utrecht University, where he obtained his BSc degree in 2008 and his MSc degree in 2010 (cum laude). He wrote his master's thesis on the lexicon-syntax interface, building on a six-month research visit to the Centre for Language Evolution of the University of Edinburgh. In late 2010 he became a PhD researcher at the Institute for Logic, Language and Computation of the University of Amsterdam, in the NWO-funded project *The Inquisitive Turn: A New Perspective on Semantics, Logic and Pragmatics*. His interest in intonational meaning was piqued during a five-month research visit to the department of Linguistics of the University of California, Santa Cruz. This dissertation presents the main results of five years of research on pragmatics, semantics and intonation.

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