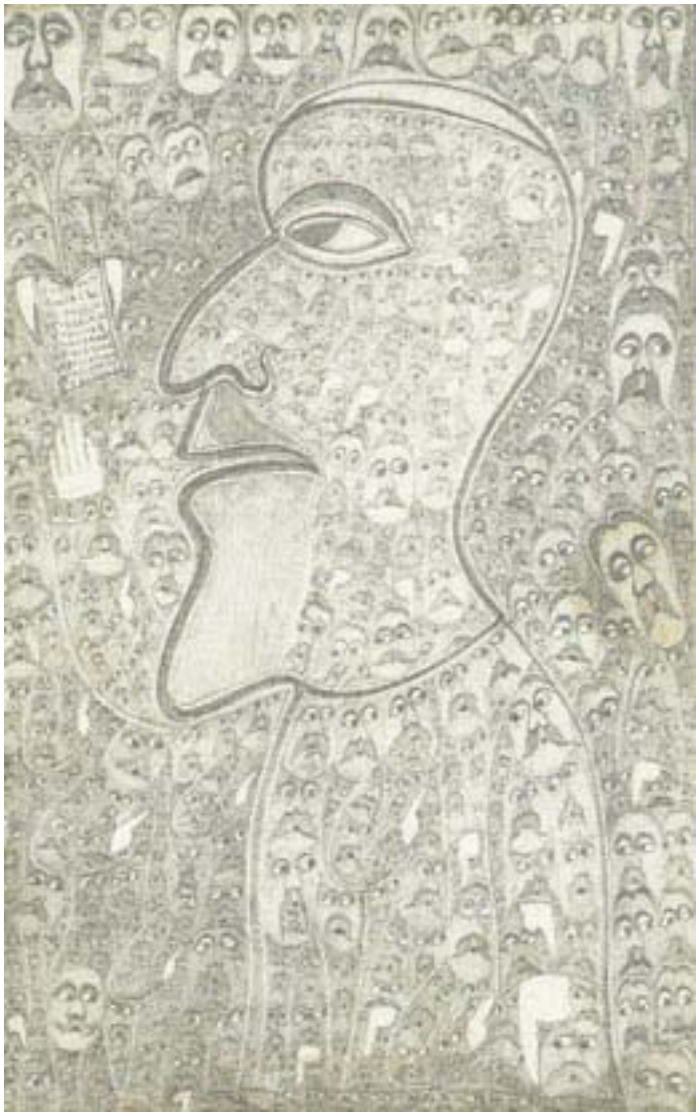
Rises and Falls

Studies in the Semantics and Pragmatics of Intonation

Marie Nilsenová



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Rises and Falls

Studies in the Semantics and Pragmatics of Intonation

Academisch Proefschrift

ter verkrijging van de graad van doctor aan de
Universiteit van Amsterdam
op gezag van de Rector Magnificus
prof.mr. P.F. van der Heijden
ten overstaan van een door het college voor
promoties ingestelde commissie, in het openbaar
te verdedigen in de Aula der Universiteit
op donderdag 12 oktober 2006, te 12.00 uur

door

Marie Šafářová

geboren te Praag, Tsjechië.

Promotor: Prof.dr. J.A.G. Groenendijk
Co-promotoren: Dr. P.J.E. Dekker, Prof.dr. M.G.J. Swerts

Faculteit der Geesteswetenschappen
Universiteit van Amsterdam

Faculteit Communicatie en Cultuur
Universiteit van Tilburg

Cover: Edmund Monsiel, 1962, *untitled*. Courtesy of `abcd art brut`.
Printed and bound by KDD GmbH Nürnberg.

ISBN-10: 90-5776-158-0
ISBN-13: 978-90-5776-158-4

Never the murdered finalities of wherewhen and yesno,impotent nongames of wrongright and rightwrong;never to gain or pause,never the soft adventure of undoom,greedy anguishes and cringing ecstasies of inexistence;never to rest and never to have;only to grow.
Always the beautiful answer who asks a more beautiful question
e e cummings

Contents

Acknowledgments

Many PhD students at some point during their studies discover that they should be able to explain what they are doing to a Random Person on the Street. This demand adds to the already hardly bearable load of expectations regarding one's thesis, with the effect that one can only manage to live with them all by suppressing them completely. But in those early afternoon hours, I still sometimes asked myself the question why I am spending so much of other people's and my own energy on a topic that is so irrelevant for the world outside of the Academia and even for most people in the linguistic field.

The only answer I have is that speech melody is beautiful. It is something very human, it serves social interaction, it tells us something about speaker's age, character and background - and despite that, it remains abstract and pure, only temporarily imprisoned by language. Analyzing a speech sample with a pitch tracker is like extracting something sublime and mysterious from a spaghetti bolognese meal. It is like the effect of Alvin Lucier stuttering 'I am sitting in a room...' and then playing and re-recording his voice in an empty room until the words become unintelligible and we hear just pure frequencies emphasized by the natural resonances of the rooms.

Despite the beauty of the topic, working on my PhD was not always an easy road and I am grateful to everybody who offered me their helping hand. I know I wouldn't have been able to make it to the end otherwise.

First and foremost, I would like to thank to my supervisors.

Thanks to Paul Dekker, for giving me the opportunity to work on a topic of my own choice and for providing support along the way. Thank you for not giving up on me in the last year(s) and for your patience, good will, the time you spent on re-reading the manuscript and for paying attention to the smallest detail.

I will always be grateful to Marc Swerts who agreed to become my external supervisor while I was already half way down the PhD road. His comments and numerous ideas on experiment design have helped to shape my views on intonation research. Thank you also for accepting me as your colleague and, together with

Fons Maes, for bringing me back into the academic life and to my thesis.

Many thanks to Jeroen Groenendijk, who was a bit more distant supervisor (his office being completely on the other side of the corridor). A substantial part of this thesis is based on his intellectual heritage and I sincerely appreciated his help as the promotion date was coming dangerously close.

I have profited from collaborating with Balder ten Cate, Marc Swerts and Robert van Rooy in Amsterdam and Tilburg, and with Philippe Muller and Laurent Prévot in Toulouse. Doing research together with them has been great fun.

Many thanks to Maarten de Rijke and the Informatics Institute, especially to Gilad Mishne, for their help with installing and running experiments on their server.

Stefan Benus, Julie McGory and Laurie Maynell were helpful and understanding ToBI specialists and Laurie was very kind to take time off her own dissertation to record utterances for one of the perceptual experiments.

The perceptual experiments I have run would have been impossible without willing participants. I appreciated very much that they took the time and I want to thank especially to Emylene Aspilla, Daniel Büring, Seth Cable, Markéta Ceplová, Hamid Ouali, Lucie Medová, Will Rose and Elisabeth Smith for spreading the word among their colleagues and friends. Special thanks to Brian Reeves who put his class of linguistics undergraduates to work.

During the last year of my PhD studies, I was profiting from the guest-friendly environment at IRIT in Toulouse. Thanks to all the people there for keeping up with my presence and for their support, especially to Marc Pauly, Andreas Herzig, Philippe Muller and Mario Borillo.

Many thanks to Jean-Marie Marandin for inviting me to become a part of his team working on French intonation and dialogue. I have benefited from discussions with him, as well as Elisabeth Delais-Roussarie, Cristel Portes, Claire Beyssade and Michel Fournel.

Thanks to Nick Asher, Jocelyn Ballantyne, David Beaver, Mary Beckman, Aoju Chen, Jacques Durand, Thorstein Fretheim, Jitka Janíková, Frank Kügler, Bob Ladd, Michiel van Lambalgen, Arthur Merin, Marc Pauly, Brechtje Post, Craige Roberts, Bernhard Schröder, Rob van Son, Martin Stokhof, Oldřich Uličný, Carla Umbach, Brian MacWhinney and Carel van Wijk for helpful discussions related to the content of the dissertation and/or making available the data on which the research is based, and to my colleagues in Amsterdam and Tilburg, especially Maria Aloni, Alastair Butler, Kata Balogh, Balder ten Cate, Marian Counihan, Helle Hvid Hansen, Ingrid van Loon, Rosja Mastop, Fabrice Nauze, Anna Pilátová, Robert van Rooy, Katrin Schulz, Per van der Wijst, David Wood and Henk Zeevat for numerous discussions on all kinds of subjects.

I also want to thank the members of my committee, Paul Boersma, Emiel Krahmer, Remko Scha, Mark Steedman and Frank Veltman for the time they spent on reading the manuscript, despite their busy schedules. A special ‘thank

you' to Emiel Krahmer who at several occasions kindly found the right words to put me back on track.

Finally, my biggest thanks go to my family and friends. Thanks to my mother, Jana Ostrowska and to my sister, Bára Šafářová, for their continuous highly valuable support. My sincere thanks to the Pauly family for baby-sitting even when they were not up to it and for helping me to build several temporary homes. Thanks also to Gisela and Peter Schade for letting me use their spare bedroom as my office for two months. And, last on the list but always first in my heart, thanks to my Aimée, a ray of sun and a source of endless energy that dominates my life.

THANK YOU!

Chapter 1

Introduction

Imagine a biologist who is sitting on a meadow, trying to discover the system behind a bug's movements. It is not simple. While sometimes, the bug clearly travels for a reason, other times it appears to move randomly and erratically. And thus the biologist is asking herself: Why do bugs move for no reason? Is nature uneconomical? Or do we just not know enough about bugs?

Speech melody is a bit like bugs. There is no doubt that when we speak, the melody of our utterances contributes information. In fact, in 1951, Stan Freberg had a famous radio sketch called 'John and Marsha' in which he used just this feature of language to create meaning. It was a parody of the then widely popular radio soap operas and in a two-and-a-half-minute dialogue, it tells the story of a couple meeting, fighting and reconciling.

> "John!
> "Marsha!"
> "John..."
> "Marsha..."
> "John?"
> "Um...Marsha..."
> (sniff) "John!"
> "Marsha?"
> "John..."

All the necessary meaning is supplied by mainly melodic changes in the pronunciation of the two names.

So speech melody is meaningful. What is confusing is that when we speak, we inadvertently produce speech melody most of the time. If there is meaning to every subtle pitch movement of what we are saying, it cannot be easily captured.

Exactly this issue – what is the meaning of speech melody and how to capture it – is the main topic of this thesis. It focuses on the melodic variations in Mainstream American English (something like the language people speak in the

U.S., unless they are from the South, the North, the West Coast or the East Coast, and certainly not if they are from the Mid-West) and Standard French (like the language they speak on French TV shows, with the expletives left out). The dissertation is structured as follows:

Chapter 2, called 'Intonation research and methodology', offers an introduction to intonational research. It defines the basic terminology, discusses methodology behind data collection and description and summarizes the main approaches to the meaning of intonation that can be found in the literature, thus placing the thesis in its scientific context.

Chapter 3, entitled 'Rising and falling declaratives', offers a survey of the existing claims on the uses of rises and the intonation of declarative questions in American English and the results of empirical studies – including one on the use of the term 'question' – which indicate that the term 'declarative question' is a misnomer and that the meaning of the intonational contours associated with questions cannot be 'questioning'. To replace declarative questions, the term '(evaluative) response-seeking declarative' is introduced and examined in experimental studies, especially with respect to various intonational features.

Chapter 4, 'Rising and falling interrogatives', is a natural continuation of the discussion in the previous chapter, in that it examines rising and falling intonation in *interrogatives* in American English. It has been claimed that the difference in interpretation between these two interrogative types is that the first asks for information, whereas the second is a request for confirmation. These notions are examined in detail and a decision-theoretic proposal is introduced and evaluated, using conversational corpus data. Subsequently, a perceptual categorization task is described, in which it was found that significantly many positive polar interrogatives with low-rising and high-rising contours in American English are interpreted as biased towards a positive answer, whereas low-falling positive polar interrogatives are linked to the expectation of a negative answer.

Chapter 5, 'Semantics for English final rises', uses the data from the previous two chapters to back up a model for the meaning of nuclear tunes in American English, in which rising intonation is treated as if it were a lexical expression, namely a modal operator of epistemic uncertainty. One of the advantages of the approach is that it stays "true to form", i.e., allows for declaratives to be treated uniformly as assertions (only interrogatives can be questions) and that it can account for the emotional and attitudinal features associated with rises. To describe the semantics formally, Veltman's update semantics is combined with a semantics for the question operator, inspired by Groenendijk & Stokhof and a formalization of Grice's maxims.

Chapter 6, 'French rises in dialogues' presents the results of a corpus study describing the dialogue function of rises found at intonation phrase/utterance boundaries. The general purpose of the chapter is to compare the American English findings with the situation in another (not so distant) language. However, in an era in which there is a definite lack of agreement regarding what dialogue

functions (relations) exist and how to identify them and the notion of an intonation phrase/utterance boundary is fuzzy at best, the observations presented here can only be interpreted as preliminary.

In **chapter 7**, 'Conclusion and future work', the findings presented in this thesis are summarized, followed by some directions for future research. It is again argued that *a priori*, there is no reason to assume that intonation in American English cannot be analyzed as intrinsically meaningful, i.e., as expressing the same meaning in all contexts.

Chapter 2

Intonation research and methodology

2.1 Introduction

The general theme of this thesis concerns three areas of linguistic research: intonology, semantics and pragmatics. Intonology – the study of intonation – is a highly empirical field which by itself requires phonetic and phonological background; theoretical semantics and pragmatics, on the other hand, are heavily influenced by logical methods. These linguistic subdisciplines, their methodologies, standards and, in a narrow sense, object of study thus differ to a certain degree. The present chapter offers an introduction to intonation research and leaves the discussion of formal semantic and pragmatic frameworks for later. I chose this structure because the knowledge of the intonational basics is crucial for the understanding of the whole thesis, while the theoretical approaches – *decision theory* (in chapter 4), *update semantics* (in chapter 5) and various approaches to dialogue description (in chapter 6) – each pertain to different research topics contained independently in the individual chapters.

In the sections below, I first define the basic prosodic terminology and address some issues regarding the methodology of intonation description and collecting data. Giving the basic definitions is pertinent also because terms like 'prosody' and 'intonation' are used in different ways in different sources. The methodological sections illustrate some problems a semanticist studying intonation may encounter; suggestions are offered as to how these problems may be solved. After discussing terminological and methodological issues, at the end of the chapter I give a broad overview of the approaches to intonational meaning which provided the conceptual space for the research reported here and summarize the main issues that will be addressed.

2.2 Basic prosodic terminology

I will use the term **prosody** as a cover term for the following properties of the speech signal: *fundamental frequency ($F0$), intensity, segmental duration, pauses* and *voice quality*. These acoustic properties are normally correlated with phonological features such as *intonation, stress, rhythm* or *speech rate* but a one-to-one mapping is impossible (for example, stress can be realized by changes in fundamental frequency, loudness and duration; conversely, not every change in, e.g., fundamental frequency is related to stress). Fundamental frequency ($F0$), sometimes also called the first harmonic, is the lowest of the frequencies that compose the (voiced) speech signal. Intensity is a term that corresponds to the perceived loudness of the signal. Segmental duration is the length in time of the individual speech segments; the same segment, e.g., the vowel [e], can have very different durations depending on its position in the word, as well as its relative prominence. Voice quality, sometimes also referred to as *timbre* is determined by the properties of the lower and higher harmonics. Higher harmonics largely depend on the structure of the vocal tract and the skeleton of the speaker's face, therefore, they are considered to be the most stable characteristics of individual speaker's speech production. It is generally assumed that of the prosodic features, $F0$ is the most linguistically meaningful, but it may just be the most frequently studied one. Some phonologists would agree that there is a lot of linguistic information in timbre and a number of studies explore the relation between spectral tilt and its relevance to stress marking (e.g., [Sluijter and van Heuven, 1996] or [Sluijter et al., 1995]). In other studies, attention has been given to the use of creaky voice (viz. also below) for marking ends of paragraphs ([Kreiman, 1982], [Lehiste, 1975]), as well as non-modal voice qualities and turn-taking (e.g., [Ogden, 2004] for Finnish).

Prosodic phenomena are normally taken to be suprasegmental, i.e., they are features that may be characteristic of longer stretches of speech and not just of individual speech segments. Speech segments are units such as *moras* (a unit corresponding to the duration of a weak syllable, containing only one short vowel in the nucleus and an optional consonant in the onset, i.e., (C)V), *syllables*, *feet* (a metrical unit, such as iamb or trochee), *phonological words*, *phrases*, *utterances* or even *paragraphs*, depending on the analysis (viz. fig. 2.1). In practice, segmental properties (microprosody) influence the suprasegmental level (macroprosody); for example, high vowels (like [i]) and voiceless consonants (like [t]) have a higher average $F0$ than low vowels (like [a]) and voiced consonants (like [d]), respectively (viz, e.g., [Whalen and Levitt, 1995]).[1] Segmental effects are assumed to be filtered out in the process of human auditory perception but can be misleading in a prosodic analysis of the speech signal, see, e.g., [Gussenhoven, 2004] for details.

[1] Prosodic prominence of the segment may also play a role. As reported by [Kingston, 2004] and others ([Reinholt-Petersen, 1978], [Ladd and Silverman, 1984], [Steele, 1986]), intrinsic $F0$ differences between vowels often do not occur unless the vowel is prominent; for obstruents (such as [p], [t], [k]), on the other hand, prosodic prominence does not seem to matter.

To illustrate the hierarchy of prosodic segments, the prosodic structure of the sentence *'Too many cooks spoil the broth'*, adapted from [Gussenhoven, 2002b], is given in figure 2.1 (s.a. [Selkirk, 1984] and [Nespor and Vogel, 1986]; for a critical discussion of the prosodic hierarchy and some assumptions behind it, see [Ladd, 1996]). In the hierarchy, an utterance (u) is composed of one or more intonational phrases (IPs) which, in turn contain one or more accentual phrases (APs), i.e., prosodic units optionally composed of one or more phonological words (PWs) carrying accents. Note that phonological word boundaries do not necessarily correspond to what we consider to be word boundaries due to writing conventions; the simplest example to show this is the behavior of clitics, which are written as separate words but prosodically attach themselves to stressed words that precede or follow them. Phonological words, in turn, are composed of prosodic feet (F) of different kinds, depending on the constellation of stressed and unstressed syllables that compose them.[2]

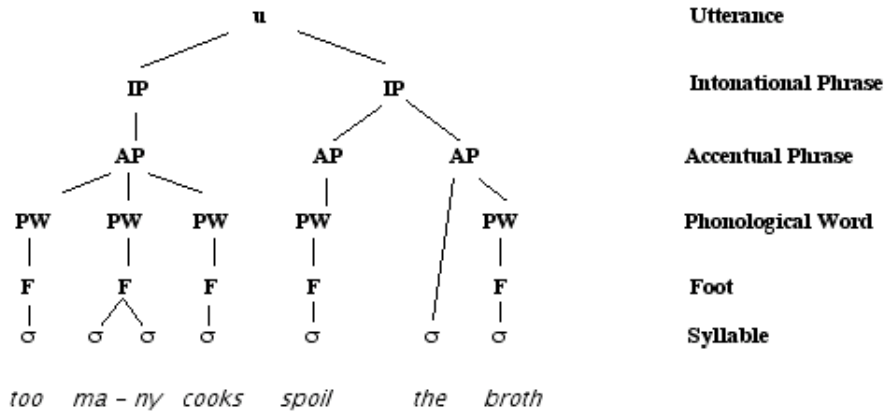

Figure 2.1: Prosodic structure of *'too many cooks spoil the broth'* (adapted from Gussenhoven [Gussenhoven, 2002b]).

The most frequently discussed segment in this thesis will be the *intonational phrase* as a carrier of intonational meaning. Despite the fact that intonational phrase boundaries are not perceptually elusive, defining them has been subject to an ongoing discussion. This is possibly due to postulation of conflicting criteria for their identification, such as combining syntactic and phonological properties (viz. the criticism of [Ladd, 1996] and, more generally, by [Karcevskij, 1931] and [Karcevskij, 2000]). In languages like English or French, intonational phrases are demarcated by various, mostly optional, prosodic events, like $F0$ movements, pitch reset to high/low on the beginning of the phrase, final syllable lengthening, a short pause or (the lack of) segmental alternations. An example of segmental alternations which normally occur across the word boundaries but are not found

[2]Following, a.o., [Jun and Fougeron, 2002], I call 'accentual phrase' here what Gussenhoven called 'phonological phrase'; I am not aware of any crucial differences between these two terms.

on intonational phrase boundaries is the lack of obstruent voicing assimilation, such as the pronunciation of /pg/ as [bg] in the French phrase *loupe grossissante* 'magnifying glass', but as [pg] across a phrase boundary, as is the case when there is narrow focus on the attribute and a boundary is thus created – *loupe* | *GROSSISSANTE*.

I will make use of the term *nuclear phrase* to refer to the utterance final intonational phrase. Examples can supposedly be found where the nuclear phrase is not utterance final, but I will not be concerned with them here. The nuclear phrase contains the nuclear pitch accent and is assumed to be especially meaningful. As argued by [Gussenhoven, 1984], there may be more pitch accents in the nuclear phrase; in the contexts in which I will use the term 'nuclear accent', it will refer to the *last* pitch accent in the nuclear phrase.

Intonation is normally defined as a combination of melody and intensity (e.g., [Palková, 1994]), but in practice the term is often used to refer just to the fundamental frequency, $F0$, (or *pitch*, its psychophysical correlate) of the signal (e.g., [Kowtko, 1996], [Nilsen, NTNU]). I have tried to be consistent in using 'pitch', '$F0$', 'melody' or 'contour' to refer to the first aspect of intonation and to reserve the term 'intonation' for cases where I wanted to include intensity (loudness) as well. The intonational properties of an utterance can be visualized as in figure 2.2, where the thick line indicates the rising and falling pitch contour, drawn into the intensity diagram (with intensity represented by the thin line) of the signal.

The authors who strictly distinguish between articulatory, acoustic and auditory features use the term 'pitch' only when referring to human perception, but not when discussing the physical (acoustic) properties of the speech signal; in that context, it would be more appropriate to talk about the fundamental frequency. Similarly, from an articulatory point of view, one would avoid the term pitch and/or fundamental frequency and instead talk about the frequency of the vocal cords. As indicated in the table 2.1 (adapted from [Hammarström, 1994]), the three sub-areas of phonetics – study of articulation, acoustics and audition – thus each use different terminology for prosodic features. I will suppose that for the purposes of intonational semantics, the terms can just be subsumed under one heading, and will use members of the pairs $F0$/pitch, and intensity/loudness interchangeably.

The study of fundamental frequency production in human and animal vocal tract is an intriguing area of research and some of its aspects will be relevant also for the current discussion; therefore, let us briefly consider the physiological aspects of pitch production. When we talk, the airflow pressed out from our lungs travels through the trachea into the nasal and oral cavity and out into the open. When we produce vowels the air travels – with some modifications – more or less freely. For the production of consonants it can get fully or partially obstructed at various points – by the vocal folds, the tongue, the mouth and the uvula. The air passing through the (open) vocal chords causes them to vibrate. The

articulation	**acoustics**	**audition**
frequency of the vocal cords	frequency of the fundamental	pitch
force of articulation	intensity	loudness
form of the vocal tract	spectrum	voice quality
duration	duration	length

Table 2.1: Prosodic features in the terminology of different phonetic subdisciplines.

vibration can be slower or faster, depending on the 'size' of the folds (their mass) and the tension in the muscles that control their use; simplifying somewhat, the higher the tension and the smaller the size, the higher the frequency with which air pulses will be released into the vocal tract, and the higher the pitch. Given that smaller people, women and children tend to have smaller and thinner vocal folds and shorter vocal tracts, the pitch they produce is generally higher (between 180 and 400 Hz for women)[3] than that of larger people and/or males, with some dependence on age (the typical male voice is somewhere between 60 and 240 Hz). This fact, together with our ability to modulate pitch, lies behind the so-called Frequency Code discussed in more detail in section 2.5.1 of this chapter.

Fundamental frequency plays a very important role in communication and the human ear is particularly well adapted to distinguish frequencies in the 100-500 Hz range (for longer and purer tones, down to the difference of 2 Hz). It seems that most (if not all) languages exploit pitch changes to signal paralinguistic information, where the term 'paralinguistic' refers to emotions and attitudes such as sadness, joy, surprise, irritation, anger, sarcasm, fear, and so on. As noted by [Ladd, 1996],

> "[p]aralinguistic cues can be consistently interpreted even in the absence of the linguistic message; for example, paralinguistic meaning comes through when the linguistic message is experimentally obscured by such means as acoustic filtering, when the linguistic message is in a language that the listener does not understand, and in some cases even when the listener is non-human. That is, stretches of speech can be produced in such a way as to convey, *irrespective of the linguistic message*, that the speaker is relaxed or impatient or aggressive or whatever."
>
> [Ladd, 1996]:33-34

[3]Most frequently, pitch is expressed in terms of Hz (number of vocal cord opening and closing events per second) or in semitones (a logarithmic unit which preserves the distance magnitude between frequencies independently of speaker's range, viz. ['t Hart et al., 1990]), though other scales can also be used, such as the ERB, viz. [Hermes and van Gestel, 1991].

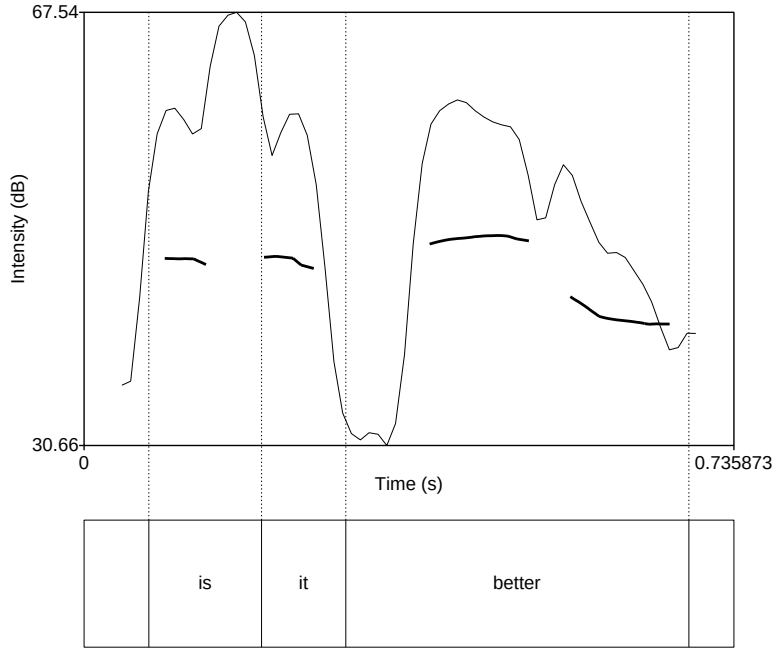

Figure 2.2: Visualizing the intonational properties of an utterance - pitch (thick line) drawn into an intensity diagram (thin line).

It has sometimes been assumed that conveying the paralinguistic meaning is the main role of intonation. There is enough linguistic evidence, though, showing that the use of intonation is at least partly grammaticalized and the association to emotions exists in parallel to its linguistic function, which in some cases (viz. section 2.5 and chapter 5), is directly derived from the paralinguistic use. For example, [Ladd, 1996] suggests that the paralinguistic message can *modify* segmental properties (e.g., smiling has a clearly perceivable effect on vowel formants, or raising voice in anger can influence the realization of lexical tones) but does not normally *distort* their phonological identity; the same principle might apply to intonation on utterance level, in that paralinguistic expressions could modify its realization but its linguistic content would remain unchanged. Put differently, paralinguistic meanings may be gradient, while linguistic meanings are rather categorical (viz. [Bolinger, 1961] or [Gussenhoven, 1999]), and gradient changes, such as high pitch accent pronounced very high in the speaker's register, should not influence categorical affiliation.[4]

From a linguistic point of view, languages employ pitch in different ways

[4]See Ladd (*ibid*) for examples why it is not always easy to distinguish linguistic features from paralinguistic – what he refers to as "paralinguistic stalemates".

(although universal tendencies can be found, viz. section 2.5.1). Some Indo-European languages use so-called lexical accent, i.e., pitch on the level of words or accentual phrases, to signal lexical or part-of-speech differences (e.g., Norwegian). The languages examined here – Mainstream American English and Standard French, with some references to Standard Dutch – apart from word stress use pitch mainly to signal properties of discourse segments.[5] Compared to lexical accents, the use of pitch on discourse level appears to be more difficult to capture in linguistic terms because it may associate with segments of various types and lengths.

Like fundamental frequency in speech, also in music, $F0$ is generally perceived to be meaningful (with, e.g., minor chords often indicating sadness and major chords joy). It is, in fact, possible that the use of pitch in language is related to the meaning of pitch in music but the connections still await more conclusive results.[6] According to [Cook, 2002], the problem with establishing links between music and speech is that pitch in linguistics has rarely been studied at a level where changes as small as a semitone are considered; pitch combinations in a musical sense have been ignored and most linguists are more concerned with macroscopic phenomena:

> "Just as no sensible music psychologist would attempt to describe the affective content of music in terms of mean pitch, pitch range or other first order statistic concerning the tones in the melody, I maintain that linguists must face the more difficult issue of pitch combinations – musical intervals and, most crucially, musical chords."
>
> [Cook, 2002]:99

Unfortunately, it lies beyond the scope of this thesis to evaluate Cook's proposal in detail and his challenge to the field of linguistics remains to be answered.

To sum up, in this section, I introduced the basic prosodic terminology that will be used in the chapters to follow. The most relevant terms were *prosody*, defined as a cover term for fundamental frequency ($F0$), intensity, segmental duration, pauses and voice quality, and *intonation*, i.e., intensity and $F0$. The term

[5] There are some dialects spoken in the Netherlands with lexical tone contrasts but these are not examined in the present context.

[6] The results of some studies suggest that processing of linguistic pitch differs from processing of musical pitch (viz. the discussion in Cook [Cook, 2002]). On the other hand, [Zatorre et al., 1992] have found evidence of right hemisphere specialization for pitch perception in *both* speech and music. [Shapiro and Danly, 1985] (as reported in [Bolinger, 1989]) and, similarly, [Pell, 1999] note that there is no difference between linguistic and paralinguistic uses of pitch with right hemisphere damaged patients. A view possibly reconciling the two camps is presented by [Gandour et al., 2004] who concludes that while speech prosody perception as such is done mainly by the right hemisphere, left hemispheric regions are involved when language processing beyond auditory analysis is required.

$F0$ will be used interchangeably with the term 'pitch', 'melody' and 'contour'. I also discussed the prosodic structure of utterances and focussed on the segment which is normally assumed to be the most meaningful part of an utterance, namely the *nuclear* (intonational) phrase, here understood to be the last intonational phrase. The term *nuclear accent*, in turn, will be used for the last pitch accent in the nuclear phrase. It was noted that in all languages, intonation can express paralinguistic meanings (e.g., emotions such as sadness or anger), but as for its linguistic functions, languages exploit intonation in different ways. Finally, with respect to the relation between the meaning of pitch in speech and in music, I noted that its exploration may require a more involved description than what is currently the linguistic standard. The ways in which intonation is described in linguistics will be introduced in the following section.

2.3 Ways to describe intonation

In order to produce reliable results, a linguistic description of intonation must take into account a number of factors regarding its production, perception and analysis. As of today, there exists no procedure for describing pitch that would free the researcher of making subjective choices – which is not an insurmountable difficulty but certainly a factor relevant in the interpretation of research results.

The initial direction in a research study usually comes from the *auditory description*, i.e., from observations such as "in language X, there is a slight fall followed by a rise at the end of questions". The reliability of an auditory description, however, is limited because – to paraphrase [Mertens, 2004] – "it requires capabilities that are rather uncommon among phoneticians and linguists," namely to correctly determine the exact shape of the pitch contour and its alignment. For instance, a final rise can be perceptually confused with a fall if accompanied with a rapid drop in intensity. The impression of a rising tune, in turn, can be due to various factors, such as a high boundary tone, a high nuclear pitch accent on the stressed syllable (with a subsequent final fall), a lack of final declination or an overall high pitch of an utterance compared to what is assumed to be the average pitch of the speaker. All of these intonational features have been reported in the literature to carry a certain semantic import (e.g., a high boundary tone conveying the lack of speaker's commitment, a high nuclear pitch accent marking "new" information, lack of final declination signaling incompleteness and overall high pitch being typical for questions). Distinguishing among them is thus crucial for the study of intonational meaning.

Contrary to pure auditory analysis, *instrumental analysis* of intonational features, where acoustic properties of the speech signal are measured with computer software, can provide more detailed information. Importantly, visual inspection of the $F0$ curve does not tell us how the contour was parsed by the human auditory system. For example, listeners tend to perceive the contour as a melodic

continuum, while $F0$ can only be measured in voiced regions of the speech (viz. fig. C.6 in the appendix). Ideally, an instrumental study of intonation should thus be accompanied with perceptual observations. For the instrumental analysis, high quality speech software is available with many different algorithms to extract $F0$ from the signal.[7] Comparing the quality of the individual algorithms is beyond the scope of the present work; all pitch trackers, however, are known to make certain detectable mistakes (see [Gussenhoven, 2004], the homepage of ToDI (Transcription of Dutch Intonation), the PRAAT manual or the PRAAT users Yahoo discussion group).

The instrumental analysis that formed a part of the research reported here was done with the help of the PRAAT software.[8] For detecting the acoustic periodicity in the signal, the accurate autocorrelation method was employed (for details, see [Boersma, 1993]), with standard settings of the accompanying parameters. The pitch range setting was adjusted to male or female voices according to the description in the PRAAT manual, modulo the speaker's range (some of the analyzed female voices were quite deep). It was observed that for the study of utterance-final contours, the pitch representation in PRAAT can be misleading in two ways. Like other pitch trackers, PRAAT can make errors due to creaky voice, i.e., speech with very low and irregular frequency (normally below 75 Hz, PRAAT's 'factory setting') which often appears at ends of utterances, viz. fig. C.1 and C.2 in the appendix. Lowering the frequency threshold, as recommended in the PRAAT manual, can have the unwanted effect that rapid pitch movements are not represented in the contour because the analysis is made on bigger time windows. Another type of error can occur following the utterance end, where PRAAT can interpret a weak voicing in the signal as a part of the speech segment; as a consequence a final rise appears as a level or even a falling contour in the PRAAT window, i.e., the tracker shows "a contour for air" (viz. figure 2.3, where the dotted line indicates the end of the speech segment after which the pitch contour is still indicated as falling). A contour for air is irrelevant for the perceptual qualities of the segment which means that cutting it off does not change the impression of the final pitch movement. Both creaky voice and end-of-utterance voicing are mostly noticeable when the perception of the utterance pitch is compared to its visual representation and thus do not pose a significant problem to the analysis.

For an analysis of intonational meaning to be possible, information about

[7] Examples of some available software include the widely used PRAAT of Paul Boersma and David Weenink from the University of Amsterdam, `GIPOS` from the Institute for Perception Research in Eindhoven or `winpitch`, developed by Aline Germain and Philippe Martin.

[8] Some of the advantages of PRAAT are that it is freely available, there are regular updates and support for users, the interface is user-friendly and the program exists for Windows, Mac OS and Unix-based platforms, which facilitates exchange of data with collaborators; this issue was of relevance especially for the research reported in chapter 6. Also, the software allows for the use of scripts, e.g., when processing and creating files in batches, or even using semi-automated methods for pitch annotation (viz. section 2.3.1 below). PRAAT scripts for a range of tasks are shared by its users on the Internet.

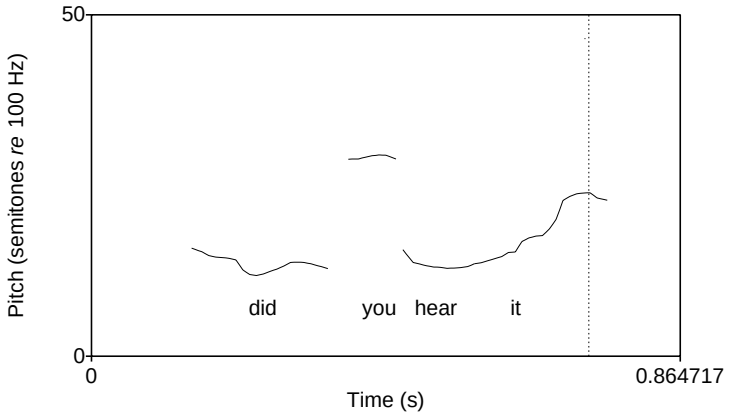

Figure 2.3: A contour "for air": final fall for a voicing after the end of the speech segment.

acoustic properties of the speech signal has to be reduced into linguistically relevant units, i.e., it has to be *symbolically transcribed*. Despite repeated attempts, there is so far no fully automated prosodic transcription available; human intervention is required on all levels of the prosodic analysis which can make it costly and (at least partly) subjective. There are many transcription systems around which differ both in their basic assumptions regarding intonational morphology, as well as in its symbolization. A very basic difference is whether a system assumes *tones* or *tunes* as morphemes: tones are individual targets ('high', 'low', and sometimes 'mid') whereas tunes are melodic movements (rises, falls, rise-falls, etc.).[9] However, the distinction only becomes crucial when intonational units are linked to meanings. In fact, a theory may take tones to be at the basis of the intonational grammar but only assign meaning to their combinations.

Below, I give some examples of intonation transcription systems. In the notation of [Cruttenden, 1997] in figure 2.4, the top and bottom lines represent speaker's minimum and maximum pitch and each dot stands for a syllable (larger dots indicate an accented syllable). In the so-called 'close copy stylization' transcription, on the other hand, the pitch contour is reproduced as a series of dots, similarly to the figure 2.3 above. Bolinger's famous technique (figure 2.5), which has been referred to as 'scrolling typewriter', uses the transcription of the utterance to mirror the contour. Also, 'down arrows' and 'up arrows' are frequently employed to indicate rising and falling movements. The same - and more - can be done with letters, as in the INTSINT alphabet of [Hirst and DiCristo, 1998], where letters are used as symbols for tonal changes together with local minima

[9]Transcription systems can also be 'broad' or 'narrow' (narrow systems include more information). For example, the ToBI convention introduced in section 2.3.2 can be made 'broader', like in the broad ToBI alphabet introduced in chapter 3.

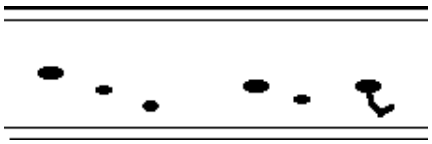

Figure 2.4: The 'interlinear tonetic transcription' (a.k.a. 'dots with tails').

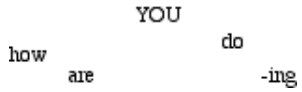

Figure 2.5: Bolinger's 'scrolling typewriter' technique.

and maxima (figure 2.6). The most common notation nowadays, however, is based on some version of the finite-state grammar of [Pierrehumbert, 1980], often referred to as ToBI (viz. the description below).

The choice of annotation standard, i.e., the system for intonation transcription, plays a significant role in the study. Generally speaking, all the existing annotation standards may be both too fine-grained and not fine-grained enough. For instance, with respect to intonational meaning analysis, some of the annotated parts may not carry any meaning; on the other hand, meaningful events in the contour may be left out from the description (e.g., the relations among tones considered crucial by [Cook, 2002], or relative pitch spans which appear to distinguish between themes and rhemes, viz. [Calhoun, 2004]). [Vaissière, 2002] advises to let the purpose of the study determine the annotation method; alternatively, one or more annotations may be used and combined with a phonetic analysis. In this thesis, a mix of approaches was employed. As for intonational alphabets, the INTSINT system for French and the MAE-ToBI annotation convention for American English were used because both have been extensively tested for the two languages, respectively, and are the default methods for transcribing their melodic properties.[10] Some claims in the intonational semantic literature (in particular, [Gunlogson, 2001]), however, concern directly the shape of the pitch contour in the nuclear phrase and the corpus data examined in chapter 4 were thus analyzed from this perspective. Similarly, in the study on the use of rises in French, the INTSINT intonational alphabet was used to automatically annotate the pre-segmented data, but a visual and auditory inspection of the pitch was also employed to validate the results of the procedure. In the sections 2.3.1 and 2.3.2 below, a more detailed description of the INTSINT and ToBI alphabets is offered.

[10] A French auto-segmental metrical proposal, i.e., "French ToBI," exists (viz. [Post, 2002] and the references there) but has not been tested for inter-annotator agreement or on larger corpora.

2.3.1 INTSINT

INTSINT (INternational Transcription System for INTonation) is a language-independent intonation transcription system developed in Aix-en-Provence (viz. [Hirst and DiCristo, 1998]). It is frequently used to transcribe French intonation but it has also been employed for other languages (viz. Hirst & Di Cristo's volume on intonational typology [Hirst and DiCristo, 1998]). INTSINT labels target points (tones) determined by the accompanying MOMEL (MOdélisation de MELodie) algorithm. The algorithm provides an automatic stylization of the macro-prosodic element in the $F0$ contour (viz. [Hirst and Espesser, 1993]), detected from the acoustic signal as described in [Martin, 1981] and [Espesser, 1982]. The stylized contour preserves the macroprosodic properties perceptible to native speakers, as validated for French by perceptual tests.[11]

INTSINT annotates both absolute and relative prosodic events (making use of the MOMEL modeled pitch curve), with the following set of symbols:

- **T** – Top; **M** – Mid; **B** – Bottom; **H** – Higher; **S** – Same; **L** – Lower; **U** – Upstep; **D** – Downstep

T, M and B are absolute points, while the rest is calculated relatively to the preceding target point; furthermore, U and D can be iterated. The coding is done automatically. An example of a part of a French utterance annotated with the INTSINT alphabet and the stylized MOMEL curve is given in the figure 2.6, with the INTSINT annotation in the second grid from above.

The transcription can be done automatically in Praat with a script, using sound segments containing single utterances (or a series of short utterances) of a single speaker. Initial and final pauses should be eliminated as these are known to pose difficulties to MOMEL. It is also advisable to adjust the settings according to the speaker's pitch range (especially for high-pitched voices), otherwise the algorithm disregards local maxima as signal perturbations.

The results of the script have to be perceptually validated. Despite this fact, the process is less time and resource consuming than manual transcriptions, such as ToBI, discussed in the following section.[12]

2.3.2 MAE-ToBI

ToBI (Tones and Break Indices) is the most widely used approach nowadays for transcribing English intonation. It originated in Pierrehumbert's dissertation [Pierrehumbert, 1980] and was further developed by M. Beckman and J.

[11] See the literature cited above or [Louw and Barnard, 2004] for a more exact description of the process.

[12] On the other hand, the annotated events are purely phonetic and may not have linguistic relevance. For the purposes of intonational meaning analysis, the INTSINT labels have to be aligned with other boundaries (e.g., pauses, intonational phrase boundaries or utterance and turn boundaries), which may require manual labeling (see chapter 6 for a discussion).

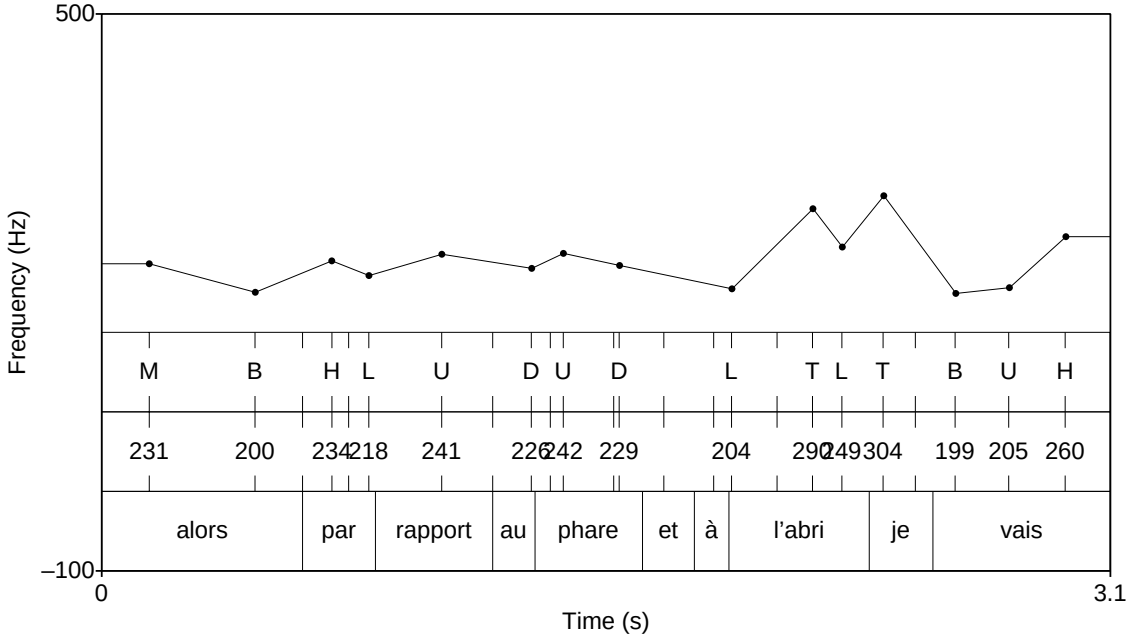

Figure 2.6: A French utterance with a MOMEL curve and INTSINT annotation.

Hirschberg [Beckman and Hirschberg, 1994]. While the original ToBI annotation system was formulated for English (and up until today, has only been extensively used and tested for this language), a similar proposal exists for other languages, such as German ([Grice and Baumann, 2002], Italian [Grice et al., 2005], Greek [Arvaniti and Baltazani, 2004], Korean [Beckman and Jun, 1996], but also Japanese [Venditti, 1997] and many others (viz. [Jun, 2005]). The standard for American English is described in the ToBI guide [Beckman and Ayers, 1994] and discussed in an overview article by Beckman et al. [Beckman et al., 2005], and is sometimes referred to as Mainstream American English ToBI (MAE-ToBI, for short).

In the ToBI labeling system, an original audio recording with its fundamental frequency contour is described on four layers, called *Tones, Words, Break-Indices* and *Miscellaneous*. The Tones layer is an autosegmental transcription of the intonation contour. It is assumed that there are three types of tonal events:

- Pitch Accents - $F0$ movements which are associated with prominent stressed syllables.[13] The following pitch accents, symbolized with a '*', are

[13]Note, however, that not all peaks and dips are aligned with stressed syllables (see [Silverman and Pierrehumbert, 1990], [van Santen and Hirschberg, 1994], [Rietveld and Gussenhoven, 1995], [House and Wichmann, 1996] and [Arvaniti et al., 2000], among others). For example, if the syllable is in a topic initial position, the peak can be pushed

assumed to exist in American English: **L*, H* (!H*), L+H* (L+!H*), L*+H (L*+!H), H+!H***.[14]

- PHRASE ACCENTS - $F0$ movements associated with right-edge phrase boundaries; depending on the composition of the phrase, they can associate with the last stressed syllable of the utterance (viz. [Grice et al., 2000]). Two basic phrase accents are postulated for American English, symbolized by '-': **L-, H-**, with the possibility of **!H-**.

- BOUNDARY TONES - $F0$ movements associated with intonational phrase boundaries. There are two types of boundary tones, symbolized with '%', associated with right edge boundaries in American English: **L%** and **H%**, and one optional boundary tone associated with left edge boundaries: **%H**.

The Words layer is an orthographic transcription of the words, aligned with their right edge boundaries. The Break-Indices layer serves to indicate the perceived degree of juncture between words, with five basic break index values assumed: **0** - very close inter-word juncture, **1** - ordinary phrase-internal word end, **2** - tones-breaks mismatch, **3** - intermediate phrase end, and **4** - intonational phrase end.

An example of the three tonal events is given in 2.7. Focusing on the last word of the interrogative, which also carries the (last) pitch accent of the nuclear phrase on its first syllable, we see a high pitch accent H* followed by a low phrase accent, connecting it with the boundary tone at the right edge boundary of the utterance. Since the end of the utterance again exhibits a movement upwards, the boundary tone is annotated as H%. Some important (nuclear) contours which will be examined in the following chapters are summarized in Table 2.2, together with their description.

Experimental studies of inter-rater agreement (especially [Pitrelli et al., 1994], [Syrdal and McGory, 2000], [Herman and McGory, 2002]) show that the MAE-ToBI notation is subjective to an extent which makes it unusable for automated prosody tagging (though some attempts have been made, viz. [Wightman, 2002]). Even skilled annotators with access to pitch tracking records frequently disagree with each other. Some categories appear to be more problematic than others. The most disputed difference is that between the H* and L+H* pitch accent, which in some phonological studies is simply abolished in order to arrive at a better inter-annotator agreement (viz. [Šafářová and Swerts, 2004] and chapter 3 where a broad ToBI alphabet is employed).[15] For a ToBI transcription to be valid,

rightwards outside of the stressed syllable.

[14] '!' symbolizes downstep (compressed pitch range), see, e.g., [Beckman and Ayers, 1994] for details. There are other diacritics in the ToBI alphabet which I will not discuss here.

[15] The H* and L+H* pitch accents are often assumed to distinguish between theme and rheme tunes in English - a claim that can be questioned on the basis that even a trained ear often cannot tell them apart.

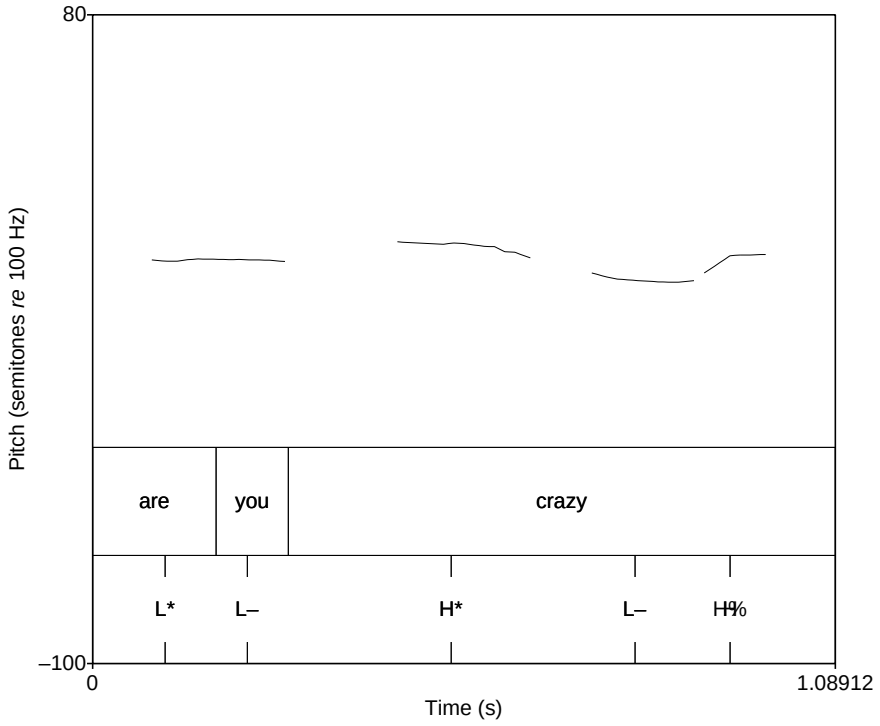

Figure 2.7: Tonal events in MAE-ToBI.

several trained annotators have to be employed and their agreement statistically evaluated.

2.3.3 Summary

To sum up, in this section two main types of intonational descriptions were discussed, namely those based on *auditory* and *instrumental analyses* of the speech signal. Auditory analysis relies purely on the perceptual impression of the listener which is often unreliable; instrumental analysis, on the other hand, uses a pitch tracker with a $F0$ extracting algorithm to visualize pitch (and, possibly, intensity). Different annotation standards exist to describe the relevant properties of the pitch contour. Two of them were introduced here in more detailed – MAE-ToBI which will be used for American English in chapter 3, 4 and 5, and INTSINT, used for Standard French in chapter 6. In the next section, some methodological issues regarding intonational data collection will be addressed.

Table 2.2: Nuclear tones with their British-style description (adapted from Ladd [Ladd, 1996]).

Nuclear contour	**Description**
H*L-L%	fall
H*L-H%	fall-rise
H*H-H%	high rise
H*H-L%	stylized high-rise
L*L-L%	low fall
L*L-H%	low rise (with narrow range)
L*H-H%	low rise
L*H-L%	stylized low-rise

2.4 Methods of collecting intonational data

In research on intonational semantics, like in any other linguistic subfield, it is crucial that the examined data stand up to empirical scrutiny. In this section, I first discuss the disadvantages of two commonly used methods, namely *pure introspection* and *generalization based on an isolated example* and then proceed to *corpus* and *experimental studies*.

Without a doubt, *pure introspection* is what drives research in theoretical linguistics. On the other hand, it is also a highly disputed method if the thus collected data serve to confirm or disprove a theory. As noted by [Labov, 1972]:199 and further discussed by [Schütze, 1996]:5, "linguists cannot continue to produce theory and data at the same time" because nothing can stop them from manipulating the introspection process to substantiate their own theories (knowingly or unknowingly). Furthermore, one of the basic rules of scientific investigation is providing 'independent access to the cause', i.e., in the case of intonational meaning analysis, to the speech stimulus which the researcher is describing. Obviously, there is no way to disagree with the description of an utterance to which no one can listen because it only plays in the researcher's head. For these reasons, it is preferable to base observations on natural examples, coming from a publicly available speech corpus. Confirmed supporters of the introspective method may consider the cases of the so-called 'question contour', the topic/focus distinction and the Givenness and deaccenting relation as reasons to doubt the method's overall validity. Regarding the 'question contour', most traditional – as well as some recent – English studies take its existence for granted, but after examining corpus data, [Pike, 1945] remarked:

> "Popular nonlinguistic tradition would seem to claim that there is a question pitch as distinct from a statement pitch; all questions are presumed to use the first of these two, and, as a corollary, the question

> pitch would not occur on statements. The evidence fails to support the assumption. There are many more contours than one for question and one for statement. Specifically, it was a marked surprise to me to find that there are many different contours which can be used on questions... and that for any contour used on a question I could usually find the same one used on a statement; likewise for all, or nearly all, contours used on statements, I found the same ones used on questions... In other words, there appeared to be no question intonation as such."
>
> [Pike, 1945]

As for topic and focus accents, the idea that there is a special tune distinguishing topics from foci lies at the core of a number of formal semantic studies, originating in the work of [Jackendoff, 1978]. However, in a large corpus study of American English, [Hedberg and Sosa, 2006] found little support for the view that topic and focus are associated with different pitch accents in spontaneous speech.[16] Similarly, [Bard and Aylett, 1999] show for Scottish English that there is no relation between Givenness (understood as repeated mention) and deaccenting, and that deaccenting is, in fact, quite rare in conversational speech.

Like pure introspection, the *use of isolated examples for broader generalizations* appears to be unsuitable as the sole method of collecting data for intonational research. With naturally produced utterances, one cannot exclude the possibility that the speaker made an intonational mistake; even more crucially, intonation use appears to be highly variable. The same sentence pronounced by a single speaker may be realized differently in different contexts, influenced by the emotional and epistemic state of the speaker, the identity and assumed emotional and epistemic state of the addressee, the prior average pitch and contour choices of the addressee,[17] and even the contour of speaker's preceding utterance. Furthermore, the use of pitch is also a personal choice (viz. [Bolinger, 1989]:9). For isolated read sentences, which are sometimes used in intonational studies, there is no guarantee that speakers pronounced them with their canonical contour (if there is one at all) or at least the most common contour.

The difficulties regarding data collection mentioned above can mostly be avoided in a *corpus study* (possibly followed by perceptual and other kinds of experimental studies, viz. below). While *read speech* corpora are usually of a

[16] Admittedly, Hedberg & Sosa's study remains controversial for methodological reasons, having to do with the definition of topics and foci, and the ToBI annotation (provided by only one annotator).

[17] For example, with respect to intonational convergence, [White, 1989], as cited by [Kowtko, 1996], found that American speakers talking to Japanese listeners adjust the fundamental frequency of their backchannels to the high frequency typical for Japanese. [Culpeper et al., 2003] give examples of 'compliant interaction' in which speakers adjust their pitch range to that of other interlocutors (see also [Brazil, 1985] and [Couper-Kuhlen, 1996]).

higher quality than *free conversational speech* corpora, they may lack in naturalness and representativeness. Free conversational speech corpora, on the other hand, are likely to contain low quality recordings with frequent overlaps and background noise. There exist also conversational speech corpora recorded in a studio (e.g., Map Task corpora). Their disadvantage is that they may be less natural than corpora containing free conversations and of insufficient size for the studied phenomenon (viz. below the discussion on sparsity of data). Apparently, the choice between read and free conversational speech may influence the results of the corpus study. For example, as shown by [Hirschberg, 2000] for American English, there is a difference in the use of rising versus falling intonation on different kinds of questions in read speech and in free conversation speech. Similarly, [Kowtko, 1996], who studied both read and conversation speech in Scottish English, concluded that the association of intonation with discourse functions differed in the two styles. All in all, the use of free conversational speech corpora – if of acceptable quality – appears to be preferable in that it ensures ecological validity of the studied examples (i.e., that they closely approximate real life use).

A particular problem for intonational data collection is that in the course of the corpus study, it may become obvious that there is a problem with defining the *object* of the study. For example, when exploring question intonation, one needs to have a working definition of what a 'question' is – independently of its intonation properties – which turns out to be non-trivial. In a number of studied languages, *yes/no*-questions are not marked by subject-verb inversion and even in English, many utterances which appear to function as questions lack the inversion, for instance if they are syntactically incomplete or have indicative syntax (the so-called declarative questions, viz. chapter 4 and 5).[18] Any method of identifying these utterances in the corpus (as in [Geluykens, 1987], [Geluykens, 1988], [Brown et al., 1980] and [Šafářová and Swerts, 2004]) is presumably doubtful unless one has access to the intentions of the speaker, e.g., through post-recording interviews, but even these may be uncertain sometimes, viz., e.g., [Grundstrom, 1973] and chapter 3 for details. Another example of under-defined linguistic phenomena are the notions of topic and focus, sometimes further subdivided into ratified/unratified and contrastive/non-contrastive. In the semantic literature, they are usually exemplified on isolated mono-clausal sentences with the structure *subject-verb-object* and mostly easy to distinguish (especially if disambiguated by an accompanying question). In free conversation speech, it may be difficult to determine which items are either topics or foci (let alone whether they are contrastive or ratified) because both choices can appear well motivated. Moreover, if one is trying to determine the typical intonational patterns associated with these categories, they first have to be identified in the text without the annotator having access to the sound recording of the material.

[18]Leaving aside the fact that many syntactic interrogatives are not meant to elicit a response from the addressee and from a pragmatic perspective are thus not questions.

This is problematic because in many cases, it is impossible to locate the topic and focus without knowing which items in the utterance were accented, i.e., without having access to the prosodic information; in fact, it can even lead to circularity if topic and focus are defined on the basis of accent distribution in the first place.

Given that large speech corpora exist for only a few languages and even for those, their size may turn out to be insufficient for a statistically proper study of a particular phenomenon, one often faces the *sparsity of data* problem. For example, as discussed in chapter 4, negative polar interrogatives or reversed-polarity tag questions are extremely rare in conversational speech corpora. This obviously makes the task of describing their intonational properties difficult. The obstacle of sparse data can be overcome with an experimental study. Another reason for doing an experimental study may be to double-check the methodology used in the corpus analysis and possibly to test speakers' perceptions (not just their production). The data used in the experiment can be natural (e.g., taken from a corpus of spontaneous conversations) or artificial to a different degree (e.g., manipulated, resynthesized or completely synthesized). Real data can bring along unwanted effects in that subjects' choices may be influenced by assumed context or lexical items in the utterances; it can also be difficult to find the desired number of examples which are all equally long, contain no background noise and no overlapping speech in the corpus. On the other hand, non-speech data (e.g., synthesized utterances composed of nonsense words or a repeated syllable) often sound unnatural and may get the subjects into a 'non-linguistic' mode, in which case their judgments are not relevant for a linguistic study. Even the use of manipulated or synthesized linguistic data may not be desirable because it confronts listeners with intonational contours which may not be representative of natural speech behavior. Therefore, in the perceptual task reported in chapter 3, preference was given to "real" corpus examples. For the interrogative study in chapter 4, however, minimal pairs of interrogative sentences were unavailable and read sentences (recorded in a studio) were used instead. In chapter 6, which focuses on the use of final rises in French, we used two corpora - a Map Task corpus and a more free version of the Map Task (the CAELEN corpus). The reason for this choice was that high quality recordings were needed for us to be able to use a semi-automated method of intonation transcription; a semi-automated method, in turn, was necessary due to the size of the task.

To conclude, we have seen that there are many different methods to collect intonational data. I have argued for the use of free conversation corpus data, if possible, mainly because they satisfy the requirement for ecological validity. In the end, though, the choice of a corpus and a method to analyze it is a pragmatic one. It may be influenced by the nature of the research question, as well as the availability of different resources (including financial ones). In the next section, I turn to the meaning of intonation. After giving some examples which show the contribution of prosody to the meaning of an utterance, I will summarize Gussenhoven's universal approach to linguistic and paralinguistic intonational

meaning, and discuss in broad outlines two types of language-specific approaches, *statistical* and *rule-based*.

2.5 The meaning of intonation

In many cases, it does not matter what the prosodic/intonational features of an utterance are. The question *Where is the train station?* can be rendered in various different ways: with an accent on *where*, *is*, *the*, *train station*, with rising intonation at the end, or with a final fall. The different prosodic realizations do not appear to have much influence on the core function of the utterance, in the sense that it would most likely be recognized as a question. For another sentence in a different context, however, its prosody can play an important role. Rhythm can be used to establish a sense of discourse coherence. Pitch and intensity help to mark discourse structure in that they can single out various items in the utterance as prominent. Intonation together with rhythm contributes to sentence phrasing, which can disambiguate the interpretation of utterances. For example, (1-a) and (1-b), due to [Hirschberg, 2002], have different truth conditions with different phrasing: in (1-a), "all civil servants can get the fare", while in (1-b), "only retired civil servants can get it."

(1) a. *This fare is restricted to retired school teachers | and civil servants.*
b. *This fare is restricted to retired | school teachers and civil servants.*

Intonation can also help to distinguish between affirmative and response-seeking utterances, as in (2-a) with falling intonation (symbolized here with a '↓') and (2-b) with rising intonation (symbolized by '↑'), respectively.

(2) a. *John hasn't come home yet*↓
b. *John hasn't come home yet*↑

Another set of examples concerns quantifier scope. In (3-a) (upper case letters indicate accentuation here), the quantifier *all* scopes over the negation ($\forall x \neg G(x)$), giving the interpretation that all men in the discourse domain "stayed at home", whereas in (3-b), it is under the scope of negation ($\neg \forall x G(x)$), giving the interpretation that there is at least one man that stayed at home (but others may have gone out). These two utterances thus contain propositions with different truth conditions. Similarly, in (4-a) (due to Paul Dekker, who, in turn, attributes it to Pieter Seuren, p.c.), the inference is that Frank doesn't do anything else but sleep at work, while in (4-b), he doesn't sleep anywhere else but at work (perhaps after first working very hard).

(3) a. ALL *the men didn't go.*
b. *All the men* DIDN'T *go.*

(4) a. *Frank always* SLEEPS *at work.*
b. *Frank always sleeps* AT WORK.

While the examples above show that prosodic features can influence the truth conditions of an utterance, prosody also fulfills some discourse functions. Specifically, as discussed by [Kowtko, 1996], it can help to perceive discourse boundaries ([Hirschberg and Pierrehumbert, 1986], [Swerts and Geluykens, 1994]) and discourse units ([Swerts and Geluykens, 1994]), [Nakajima and Allen, 1993]), to signal turn taking ([Brown et al., 1980]) and expanded/higher pitch range signals new topics ([Brown et al., 1980], [Ayers, 1994], [Grosz and Hirschberg, 1992]).

Out of the various prosodic features, intonation (and especially pitch), has been assumed to be the most important carrier of meaning ([Cook, 2002]). A number of proposals have been made to model the meaning of intonation: below, I list those relevant for the content of this thesis, starting with the universal claims and proceeding to the language-specific ones. Despite the fact that some universal tendencies have been observed, the widely adopted position is that intonational meaning[19] is language specific and that languages may differ both in their intonational grammar, as well as with respect to the meaning the intonational morphemes (and/or their combination) express.

2.5.1 The universality of intonational meaning

It has been argued that languages share some universal tendencies in the use of intonation and intonational universals can provide for interesting hypotheses.[20] An example of what has long been assumed to be an intonational universal is the supposedly wide-spread tendency for questions to be signaled with rising intonation (70 % of a sample of 250 languages, viz. [Bolinger, 1978a]). One problem with the generalization is that the claim concerns only *yes/no*-questions, and even for this class it is not based on corpus or experimental results. In languages for which corpus studies have been done (such as English, viz. [Fries, 1964] and [Hirschberg, 2000], or French, viz. [Fónagy and Bérard, 1973]), the original observation had to be modified because in some corpora, less than 40 % of spontaneous polar questions were, in fact, rising. Further crosslinguistic evidence was recently offered by [Rialland, 2004], who observes that in a database of 80 African languages, questions without any pitch raising, high tones or rising intonation were quite common (e.g., in the Gur languages, as well as among the Kwa, Kru and Mande languages). Also, even in languages with rising questions, the contour may not be considered the canonical polar question contour (for example, for Greek, [Arvaniti, 2002] argues based on experimental evidence that the

[19] I.e., beyond word prosody, which is obviously not universal.

[20] The field of intonational typology is recently rapidly developing ([Vaissière, 1995], [Hirst and DiCristo, 1998], [Jun, 2005], [Grabe, 2002]), however, no typologically representative sample of languages from different languages groups and families has so far been collected.

default *yes/no*-question melody is L*H-L%).

Apart from linguistic data, universal claims regarding intonation use have been based on physiological facts about intonation production. For example, [Huttar, 1968] (as reported in [Chen, 2004]:2), observes that the degree of perceived emotion (bored-interested, calm-excited, afraid-bold, etc.) is positively correlated with intonation across unrelated languages, and suggests that this is due to a universal factor behind the physiology of emotion and voice production (emotion leads to an increase in muscular tension and activity and hence to higher pitch). [Ohala, 1983] and [Ohala, 1984], on the other hand, proposes an ethological basis for the use of pitch which makes use of the observation that in the animal kingdom, deep sounds are interpreted as threatening, while high pitched sounds are interpreted as weak and submissive.

Building partly on the work of Ohala, Gussenhoven ([Gussenhoven, 2002a], [Gussenhoven, 2004]) identifies three biological codes related to the use of pitch for signaling information (both paralinguistic and linguistic). The three codes, called the *Frequency Code*, the *Effort Code* and the *Production Code*, are based on the following observations (as formulated in [Gussenhoven, 2002a]):

> **The Frequency Code.** Smaller larynxes contain lighter and smaller vocal cords, with which faster vibration rates are achieved for a given amount of energy. The correlation between larynx size and rate of vocal cord vibration is exploited for the expression of power relations across species: lower pitch is associated with larger body size and hence with social dominance ([Ohala, 1983], [Ohala, 1984]).
>
> **The Production Code.** The generation of energy is tied to the exhalation phase of the breathing process, and hence becomes available in phases. As a consequence, high pitch is associated with the beginnings of utterances, while low pitch is associated with the ends.
>
> **The Effort Code.** The amount of energy expended on speech production can be varied: putting in more effort will not just lead to more precise articulatory movements, but also to more canonical and more numerous pitch movements. Lavishing more care on the production process means less slurring together of these movements, causing them to be carried out with less undershooting of targets.

Gussenhoven's hypothesis is interesting because, among other things, it relates phonetic and phonological aspects of pitch use and makes specific predictions regarding their linguistic interpretation. With respect to the relation between phonetics and phonology, the biological codes are assumed to be phonetically implemented in the paralinguistic production and interpretation of pitch in all languages[21] and to have an effect on the phonology in most. While linguistic in-

[21] [Chen, 2004] examined the paralinguistic interpretation of the codes in a series of perceptual

tonational meaning may diverge from the canonical interpretation provided by the codes as a result of language change, overall, languages are expected to exhibit the tendency to use grammatical categories directly derived from the paralinguistic meaning. Moreover, even in those languages where the linguistic implementation of intonational categories goes against the biological codes, speakers will still exploit the original phonetic effect to convey their attitudes and emotions.

The Frequency Code is based on Ohala's claim that there is a correlation between larynx size, fundamental frequency and body size, which is used for expressing power relations. In Gussenhoven's interpretation, the code's paralinguistic interpretations are for high pitch 'submissiveness', 'femininity', 'politeness','vulnerability' and 'friendliness', whereas for low pitch it is 'dominance', 'masculinity', 'confidence' and 'aggression'. On the level of linguistic information, higher pitch is supposed to convey 'uncertainty' (as opposed to 'certainty') and hence 'questioning' (as opposed to 'asserting'), based on the idea that "when asking questions, one is dependent on the other's good will for the information requested" ([Chen, 2004]:33).

The Production Code is supposedly linguistically exploited to signal new topics (with high pitch), as opposed to topic continuations (low pitch). The basis for it, which is usually referred to as 'final lowering', was described for English by [Liberman and Pierrehumbert, 1984]. Note that at least in some cases, though, the Production Code can have an opposite tendency to the Frequency Code, as it predicts that speakers will have the predisposition to lower their pitch towards the end of their utterances, a tendency which may conflict with their exploitation of the Frequency Code to signal power relations.[22] In practice, it may also be difficult to test the effects of the two codes independently.

Finally, the Effort Code is claimed to be behind large pitch excursions associated with informationally salient items.

Although Gussenhoven brings forward typological and experimental evidence to support his claims regarding linguistic interpretations of the codes, his proposal can be doubted on at least two grounds, elaborated below, namely the association between the Frequency Code and questions, and the difference between the linguistic implementations of the three codes.

In spite of the fact that traditional typological studies such as [Uldall, 1964] or [Bolinger, 1978a] show a crosslinguistic pattern for the use of rising intonation and/or high pitch in *yes/no*-question, it would be incorrect to conclude that questioning and rising/high pitch go crosslinguistically hand in hand. First of all, the association found in the typological studies did not concern alternative and *wh*-questions, which appear to show the opposite tendency, i.e., to be mostly

experiments and found varying tendencies in judgements of speakers of different languages. I will leave this point aside here, though, since I am mainly concerned with the linguistic meaning.

[22]Margaret Thatcher was supposedly advised to lower her pitch towards the end of her utterances to signal confidence and, as a result, was constantly interrupted by her conversation partners who thought she was signaling a turn end ([Beattie et al., 1982]).

falling. If we accept the idea that questions express lack of confidence, it is not immediately obvious why alternative and *wh*-questions should differ from *yes/no*-questions.[23] Second, the cited typological studies were somewhat biased in that they did not use a typologically representative sample of languages and made reference to data collected and described by empirically less reliable methods (i.e., pure introspection, reported introspection, auditory analysis) and not based on corpus or experimental results.[24] Given some existing experimental results, it also seems that while the relation between frequency and body size may be quite straightforward for non-primates, it is more complex for primates and especially humans. In some studies ([Künzel, 1989], [van Dommelen and Moxness, 1995]), it has been argued that there is no correlation between $F0$ and body size in adult humans. This is due to the fact that there is no actual correlation between larynx length and/or the thickness of vocal folds and body size (neither height nor weight) which both influence $F0$; male larynx and vocal folds in fact grow independently of the rest of the body in puberty, so that adult males' $F0$ is typically half that of adult females, although they are only about 20% heavier (viz. [Fitch, 2000] and references there). [van Dommelen and Moxness, 1995] report that while speakers' judgements of speakers' body size appeared in their study to be based on three properties of speech - speech rate, $F2$ formant frequency (which directly reflects vocal tract length) of the schwa[25] and $F0$, of these three only speech rate was a reliable feature, and $F0$ was, in fact, the least reliable one.[26] Finally, as pointed out by [van Alphen, 2003] on the basis of an analysis of natural conversations, questions are normally used as a floor-getting device and their role in a dialogue is to assert a discourse topic and to commit the dialogue participants to its resolution – acts which cannot easily be charac-

[23] [Merin and Bartels, 1997] propose that *wh*-questions are asserting (whereas *yes/no*-questions are not) in that the speaker maintains that at least some individual or entity in the discourse domain, if substantiated for the *wh*-variable, makes the proposition contained in the question true. For various reasons, briefly addressed in this section and again in chapter 3 and 5, this account is not satisfactory. The authors later modify their position by allowing also for *yes/no*-questions to be asserting [Bartels and Merin, 1998].

[24] To anticipate the discussion in chapter 3, these facts cannot be explained by adopting the Functional Hypothesis of J. Haan [Haan, 2002], which predicts that intonational marking of questions is in reversed relation to morpho-syntactic marking, because both in English and French there are rising declaratives which are not response-seeking (question-like) and falling declaratives which are. This fact undermines Haan's hypothesis which would predict that response-seeking declaratives should always be intonationally marked.

[25] $F2$ is the abbreviation for the second formant, an overtone of the fundamental frequency, which together with (primarily) the first formant contributes to the quality of a sound, such as a vowel. The sound wave associated with a vowel is composed of several frequencies, or several pitches, the lowest one being the fundamental frequency with which one is concerned in intonation research. The frequencies above the fundamental help to distinguish vowels like [i], [u] and [e] from each other.

[26] Possibly, the interpretation of $F0$ in the Frequency Code is not based on body size but on the age of the speaker: high pitch signals that s/he is very young or very old, a condition which may, in turn, be related to lack of social power.

terized as submissive or uncertain. Similarly, as discussed by [Bartels, 1999]:10, [Lewis, 1969], characterizes questions as imperatives which "command an action"; also [Katz and Postal, 1964] interpret the question morpheme as *'I request that you answer'* and Hintikka ([Hintikka, 1974], [Hintikka, 1978]) combines the imperative operator *'Bring it about that...'* with *'I know that X'*. These authors thus interpret questions on a par with imperatives. Similarly, Bolinger remarks that "questions oscillate between the force of requests and that of orders" (as cited by [Bartels and Merin, 1998]:98).

A different explanation for why speakers nevertheless tend to associate rises with questions would be to assume that there is a link between rising intonation and *discourse topics* and that it is because questions normally introduce discourse topics in a conversation, that they frequently occur with rising intonation; hence the canonical interpretation of rises as questioning. In other words, the correlation between final rises and questions could be due to a third variable. However, the idea that rises on questions could be due to their topic-introducing function is not compatible with Gussenhoven's proposal, since he assumes that the intonational realization of the Frequency Code (on questions) should differ from that of the Production Code (for topics). In particular, a higher *end pitch* and *delayed peak* are attributed exclusively to the first code. Note, though, that [Wichmann, 2000] found a correlation between discourse topics and both high end pitch and delayed peak in English. To sum up, one cannot in principle exclude the option that the Frequency Code has no linguistic reality (though it may very well be exploited for paralinguistic purposes) and the effects ascribed to it in Gussenhoven's proposal are actually implementations of the Production Code.

Gussenhoven's biological codes were interpreted as universal maxims of conversation by [Hirschberg, 2002]. She proposes that the codes constitute communicative conventions which, similarly to Grice's [Grice, 1975] maxims of rational cooperative conversation exchange, are context-dependent and defeasable and can give rise to conversational implicatures. Hirschberg formulates the following four maxims:

1. *Maxim of Pitch:* Try to make the rise or fall in the pitch of your utterances correspond to the degree of confidence you wish to convey. Let your pitch rise to convey uncertainty and fall to convey certainty.

2. *Maxim of Emphasis:* Try to make informationally important portions of your speech intonationally prominent.

3. *Maxim of Range:* Let the width of your pitch range reflect the location of your utterance in the topic structure of the discourse. Increase your range to start new topics. Decrease your range to end old ones.

4. *Maxim of Phrasing:* Phrase your utterance so that it is divided into meaningful portions of speech.

Hirschberg is aware of the fact that crosslinguistically, intonation is not always used as codified in the maxims and suggests that both the *maxim of pitch* and the *maxim of emphasis* may be implemented differently in different languages. In effect, her proposal - at least for the *maxim of pitch* - thus collapses to the rule that the speaker should express uncertainty if she is uncertain (in whatever way is conventional in her language). One could argue that this principle is already expressed in more general terms by Grice's maxim of quality. Also, it is unclear how speakers exploit Hirschberg's maxims to express conversational implicatures, especially given that they can be violated without any apparent interpretational effects. For example, in fast speech, an utterance could be pronounced without any clear phrasing, in monotonous speech, even informationally relevant items would not be prominent and new topics would be pronounced with no increased range. These violations, though easily noticeable, (unlike, e.g., a violation of the maxim of quality which requires special knowledge) do not appear to generate any conversational implicatures. In general, it thus seems incorrect to interpret the principles above on a par with Grice's maxims of rational conversation behavior. One could perhaps more successfully interpret them like other, more or less universal, rules, such as 'place topic sentence-initially,' 'express agents as grammatical subjects' or 'use a pronoun to refer to a salient referent', using the optimality-theoretic framework. This idea will not be further developed here.

To conclude, while it has been observed that many languages seem to share some basic properties of their intonational systems, further empirical evidence often casts doubts at the hypothesis about their universality. As observed by [Fretheim, 2002]:

> "Until we know a lot more about language-specific constraints on intonational form we should [...] refrain from making very bold predictions about the universality of form-meaning correspondences in our research on the role of intonation in utterance interpretation."
>
> [Fretheim, 2002]:6

2.5.2 Language-specific approaches

Within language-specific approaches to the meaning of intonation, one can distinguish between two perspectives, which I will refer to as *statistical approaches* and *rule approaches*.[27] Statistical approaches are based on corpus studies in which conversation moves (labeled according to a predetermined dialogue act scheme) are statistically linked to intonational patterns. They often have as their goal

[27]This distinction is, admittedly, not clear-cut in that there exist techniques used in intonation research which generate "rules" on the basis of statistical methods. For an example, see [Fournier et al., 2006] who employ the CART (Classification and Regression Trees) method.

the description of intonation use for purposes of speech recognition and synthesis, hence their preoccupation with statistical tendencies rather than categorical rules, which are often elusive. Rule approaches, on the other hand, attempt to generalize over the meaning of intonational morphemes by evaluating individual sentences, mostly using researchers' intuitions. Though applicability of the result may be of importance, their primary role is to describe the intonational grammar in a theoretical linguistic sense. Put differently, they look for grammatical rules.

Below, I summarize the basic characteristics of the proposals that are representative of the two categories; I will return to their details in the coming chapters. I consider [Kowtko, 1996] for Scottish English, and [Fletcher et al., 2002] and [Mushin et al., 2003] for Australian English to be examples of the statistical approach. The work of [Gussenhoven, 1984], [Pierrehumbert and Hirschberg, 1990], [Merin and Bartels, 1997], [Bartels and Merin, 1998], [Gunlogson, 2001], as well as [Steedman, 2004a], [Steedman, 2000] and also of Marandin and Beyssade and their colleagues [Marandin et al., 2004], [Beyssade and Marandin, 2004] is placed into the category of rule approaches.

Statistical Approaches

The rapid development of speech technology in the last ten to fifteen years has sparked interest in intonational descriptions, especially after it was found that the naturalness of intonation is ranked highly in speech software evaluations by its users, and that intonation can provide important linguistic cues for speech recognition (viz. [Shriberg et al., 1998] and the references below). In the following two subsections, I summarize the results of larger studies which focused on the linguistic function of intonation in discourse. The work of Mushin et al., Fletcher et al. and Kowtko was selected because their approaches provided methodological clues for the study of French rises, reported in chapter 6.

[Mushin et al., 2003] analyzed four dialogues from the Australian Map Task, labeled with Australian English ToBI (viz. [Fletcher and Harrington, 1996] and annotated for so-called full Common Ground Units, "minimal units of acknowledged common ground" ([Nakatani and Traum, 1999]) which were taken to form the dialogue structure. The Common Ground Units were further divided into *complex* and *simple*, depending on whether they consisted of more contributions by either the instruction giver or the instruction follower, or just involved a simple exchange of an initiating move and a responding move. In fact, this distinction turned out to be crucial because it was found that both for initiating contributions and for responses, a higher proportion of low falling boundary tones (L-L%) was found in the complex Common Ground Units than in the simple Common Ground Units. Also, a lower proportion of low rising boundary tones (L-H%) was found in initiating acts in the complex Common Ground Units. In general, though, there appeared to be no interpretable tendency in the data, e.g., correlating certain ToBI patterns with types of conversational moves, suggesting that

perhaps the discourse structure annotation chosen by Mushin and her colleagues, or its combination with the intonation labels, may not have been relevant with respect to intonational meaning.

[Fletcher et al., 2002] [28] also examined Australian English Map Task dialogues labeled with ToBI, but instead of Common Ground Units, they focused on dialogue acts, classified by the modified DAMSL scheme [Stirling et al., 2001]. They concluded that in their corpus, information requests and tags (questions) were almost always realized with a (high-onset) high rise (H*H-H%, as opposed to L*H-H%), whereas statements and action directives rarely appeared with this type of contour. The study of Fletcher and her colleagues is quite exceptional in the existing literature regarding the level of detail with which it analyzes both dialogue moves and intonational contours. Even that may not be enough, however, to capture all the existing variation, as the use of different types of rises in Australian English also appears to be related to gender [Fletcher and Harrington, 2001] and age [McGregor, 2003].

Kowtko in her dissertation ([Kowtko, 1996]) and in [Kowtko and Isard, 1993] on Scottish English examines the function of intonation in single-word utterances in both read and spontaneous speech. For discourse description, she uses *Conversational Games Analysis* [Kowtko et al., 1992]. There, a conversation is divided into *games* which are, in turn, composed of *moves*. To annotate the intonational patterns in the corpus, Kowtko used her own system of intonation transcription in which the one-word utterances she studied were categorized as either **H**, **L**, **HL**, **LH** or **LHL**.

For conversational speech, Kowtko found that certain kinds of moves (namely, ALIGN and ACKNOWLEDGE in her taxonomy) correlated significantly with rises, while others (REPLY-Y) correlated significantly with falls. Interestingly, she observed a dependency between the kind of game in which a dialogue act occurred and its intonation, the role of the speaker and also the corpus style (read speech versus conversational speech).

Kowtko's study illustrates both the advantages and the disadvantages of the statistical type of approach to studying intonation. One obvious advantage is that on the basis of statistical significance, one can exclude the possibility that an observation is, in fact, caused by an intonational rarity or even a mistake. Also, significant correlations can be found between an intonational feature and combination of discourse features (such as speaker role, type of game and type of move), which can be of substantial interest to a subsequent theoretical study. On the other hand, Kowtko's sample was statistically biased in that it contained only one-word utterances (moves). It seems likely that for this reason, there were very few question moves (or QUERY and CHECK in her taxonomy) in the sample and the study did not confirm the typical link between these kinds of utterances and rising intonation.

[28] A similar, but phonetically based study is [Fletcher and Harrington, 2001].

Rule approaches

For the second type of approaches to the meaning of intonation, the proposals of Gussenhoven, Pierrehumbert & Hirschberg, Merin & Bartels, Gunlogson, Steedman and what I will refer to as the 'Paris approach' ([Marandin et al., 2004], [Beyssade and Marandin, 2004]) are described below. For a critical summary of older theories, e.g., [Pike, 1945], [Halliday, 1967], [Liberman and Sag, 1974] and [Brazil, 1975], see [Gussenhoven, 1984] and [Chen, 2004]. In the following subsections, I give a general description of the cited works; I will return to some of them in more detail in chapter 5 of the thesis.[29]

In the proposal of [Gussenhoven, 1984], nuclear tones signal the interpretation of the speaker's contribution with respect to the dialogue common ground ('background', in his terms). The contribution is interpreted as either an ADDITION - adding a variable (expressed with H*L), a SELECTION - selecting a variable (expressed with H*LH), or TESTING - choosing not to commit as to whether the variable belongs to the background or not (expressed with L*H). The final tune meaning is assumed to be compositional. Despite the fact that Gussenhoven's proposal has been judged non-applicable to American English by [Ward and Hirschberg, 1985] and [Pierrehumbert and Hirschberg, 1990], his ideas can be found at the basis of most of the later approaches to intonational meaning. Also, his proposal shares two important properties with all the others treated in this section: it is compositional and it analyzes intonational features as relating speaker's contribution to the conversational common ground.

[Pierrehumbert and Hirschberg, 1990] assume that intonational contours specify if the proposition conveyed should be added to the set of mutual beliefs, excluded from it or just serves to highlight a relationship to some other proposition in the set. With the intonation grammar of [Pierrehumbert, 1980] and [Beckman and Pierrehumbert, 1986] at its core, the meaning of individual tones (specified in the table in 2.3) combines in a strictly compositional way to give the resulting meaning of a contour.

Given that Pierrehumbert & Hirschberg's proposal is not made on the background of a particular semantic model, the suggested meanings are quite general. At the same time, the main problem for the model appears to be that it cannot deal with the variability found in the data. For example, as already noted above, both *yes/no*-questions and, even more frequently, *wh*-questions appear with a low boundary tone. In Pierrehumbert & Hirschberg's systems, though, one would expect them to appear solely with a H% (perhaps except for rhetorical questions) because they have a forward-looking function in the dialogue (for the same point, see [Cruttenden, 1997]). It also does not seem to be tenable that all instances of H* are found on items that are new in the discourse; conversely, not all new items carry an H* accent (viz. the study of [Hedberg and Sosa, 2006]

[29]Note that the notations in the sources described below, though employing the **H** and **L** letters, are not direct implementations of the ToBI alphabet currently in use.

Table 2.3: The meanings of tones in Pierrehumbert & Hirschberg's proposal [Pierrehumbert and Hirschberg, 1990].

H*	the accented item is new in the discourse; the proposition should be added to the mutual beliefs
L*	the accented item is old; it should be excluded from the proposition the speaker wishes to add to the mutual beliefs
L+H*	speaker's commitment to the proposed scale
L*+H	a lack of speaker's commitment to the proposed scale
H*+L	the accented item is mutually believed
H+L*	support for proposition being true can be indirectly inferred from the mutual beliefs
H-	the intermediate phrase should be interpreted together with the following phrase
L-	the intermediate phrase should be interpreted separately from the following phrase
H%	the intonational phrase is forward-looking
L%	the intonational phrase can be interpreted without reference to the following one

already mentioned above). Other points of criticism concern the independent reality ascribed to H* and L+H*, which is highly questionable (as already mentioned above) and the combination of phrase accents with boundary tones (e.g., H-L% or L-%H) which appears to be difficult to interpret in the system (see also [Chen, 2004] for a discussion).

[Merin and Bartels, 1997] propose (for English) that the core meaning of falls, rises and "their compounds" on focused elements can be expressed in terms of allocation of the *dominance parameter* in a speech act. Their approach is based on Merin's 'algebra of social acts' ([Merin, 1994]), a game-theoretical description of a conversation as a bargaining game (e.g., [Nash, 1953]). In the game, the players are concerned with establishing the content of their common ground [Stalnaker, 1978], reconciling their preferences. Rise (with a low pitch accent and a high phrase or boundary tone) alienates dominance over the acceptance of a proposition to the hearer, while a fall (with a high pitch accent and a low phrase or boundary tone) appropriates it. Crucially, by giving up dominance, the hearer also fails to assert the proposition contained in her utterance. The idea that the use of the rise (albeit differently defined) reflects addressee's dominance or commitment with respect to a proposition in the common ground can be found in two other recent proposals.

Gunlogson, like the authors above, is not concerned with the meaning of individual tones but with the contours of nuclear phrases as a whole. Disregarding

interrogatives, she focuses on the instances of final rises on syntactic declaratives and implements the hypothesis that rising declaratives commit the addressee to the proposition expressed, while falling declaratives commit the speaker.

[Steedman, 2004a] builds on earlier work ([Steedman, 1991], [Steedman, 2000]) in developing a semantics for intonation anchored in Combinatorial Categorial Grammar. He assumes that a part of speaker's knowledge in a conversation is formed by two commitment sets, S a set of propositions that the speaker is committed to and H a set of propositions the hearer is committed to. An attribute associated with the propositions in the commitment set is the feature $+/-AGREED$, depending on whether the 'information unit' formed by the proposition is claimed by the speaker to be contentious or not. With this rather simple setup, Steedman classifies pitch accents and 'boundaries' (phrase tones and boundary tones and their combinations) as summarized below.

- speaker's commitment = L, LL%, HL%
- hearer's commitment = H, HH%, LH%
- agreed theme = L+H*
- non-agreed theme = L*+H
- agreed rheme = H*, (H*+L)
- non-agreed rheme = L*, (H+L*)

One of the predictions of Steedman's model is thus that a high boundary tone should always be associated with hearer's commitment, while a low boundary tone indicates speaker's commitment. Although conceptually similar, the approaches of Merin & Bartels, Gunlogson and Steedman differ in some crucial aspects regarding both the intonational meaning, as well as the shape of the final rise. I will return to the details of the analyses in chapter 5.

Finally, to model the meaning of final contours in French, Marandin and his colleagues ([Marandin et al., 2004], [Beyssade et al., 2004]) build on Ginzburg's approach to dialogue. The information state is split into two components, one being the discourse participant's idea of what constitutes the joint set of current public commitments (the 'dialogue gameboard'), the other being her own – non-publicized – state of knowledge. Each of these two components is divided into further subcomponents. For the dialogue gameboard, the crucial dimensions are the *shared ground*, the QUD ('question under discussion') and the *latest move*. In the non-publicized state of knowledge, there are two components which can be distinguished from each other: the *goal* of the speaker in uttering something and the *background*, the unpublicized knowledge store of the conversation participant. The authors propose to further subdivide the background into 'what the speaker knows/believes' and 'what the speaker assumes the addressee knows/believes'.

To account for the use of rising and falling contours, Marandin et al. suggest that falling contours are used when the relation between the two components of the background with respect to some issue is non-defective – what the speaker knows/believes about a given issue is, or may be, compatible with what she assumes the addressee knows/believes about the same issue. Non-falling contours, on the other hand, are used when the relation is defective – what the speaker knows/believes about a given issue is not, or may be not, compatible with what the speaker assumes the addressee knows/believes about the same issue. If the speaker perceives the relation to be defective with respect to her current utterance, she will expect some feedback from the addressee (e.g., in the form of an acknowledgement), which presumably explains why rising declaratives often have the same effect as questions. From a semantic point of view, both rising declaratives and interrogatives are *underspecified* for their meaning (J.-M. Marandin, p.c.) and it is up to the addressee to interpret them as either assertions or questions.

To sum up, all the rule-based proposals discussed here contain important assumptions regarding intonational meaning, namely that it is compositional and that it is related to the beliefs of conversational participants regarding the truth of the expressed proposition and the content of the common ground. One thing they have in common is that they are prevalently based on the authors' introspective judgments. The claims they make regarding the intonational nature of 'final rises', as well as their meaning, formed a substantial part of the investigation described here. In the next section, I will focus on the research questions that will be explored in the rest of the thesis.

2.6 C'est quoi le pitch?

As may be clear from the discussion in the previous section, there is a general consensus that intonation is linguistically meaningful. No agreement, however, has so far been reached on a number of issues. In the upcoming chapters, I attempt to address some of these issues in a way outlined below.

First of all, it is not clear what the intonational lexemes are. For example, in the approaches summarized above, some authors (like Pierrehumbert & Hirschberg) assumed that more or less all ToBI units are meaningful, while others (like Gunlogson or Marandin and his colleagues) assign meaning to whole tunes (rising/falling). Part of the problem, noted by [Krahmer and Swerts, 2005], is that it is difficult to devise constituent tests showing how the meaning of an utterance is affected by replacing a tone or a tune with a different one. Also, given that intonation is perceived as a continuum, it is impossible to say what the smallest possible intonational unit would be and then test it for possible content. Note that taking units of an existing intonational alphabet like ToBI as the basis for the semantic investigation leads to theoretically biased results, especially be-

cause none of the existing transcription standards is uncontroversial. The starting position for the research reported here will be the generally accepted assumption that intonation is meaningful on the level of utterances, particularly if they are turn-final. Since utterances can be of highly varying length, in order to compare their properties, a further assumption I will make is that they are composed of intonational phrases and that the last of them (the nuclear phrase) is especially meaningful, starting from the last pitch accent of the utterance.

A very basic intonational distinction that one can observe is that between what listeners perceive as rising and falling tunes at right-edge utterance boundaries (or, as assumed here, in the nuclear phrase). In many sources, the final rise is simply taken to be a question marker and this interpretation also seems to correspond straightforwardly to speakers' intuitions. However, as already noted above, corpus studies indicate that there are questions without rises and rises without questions. Does this mean that the meaning of the rise is not invariant? Or is there perhaps a difference between production and perception, in the sense that listeners always interpret rising intonation as questioning, but this fact is not reflected in the production? Is the meaning of the final rise "weak", in that it can be overridden by features of the context and other properties of the carrier utterance? In fact, although intonation is assumed to be meaningful, some researchers have claimed that it does not have *intrinsic* meaning (e.g., ['t Hart et al., 1990]) but that what it conveys depends on properties of the context and of the utterance itself. Possibly another way of putting the same is to delegate intonational meaning into the realm of pragmatics. Although the boundary between semantic and pragmatic phenomena is sometimes unclear (as, e.g., in the case of anaphora), the two linguistic components serve to distinguish between truth-conditional meaning interpretable on the utterance level (semantics) and meaning determined by contextual factors (pragmatics). One could thus use pragmatic processes to explain why intonational meaning appears to be strongly context-dependent. As a matter of fact, all the rule-based approaches discussed in the previous section do exactly that because they attempt to explain the meaning of final rises and falls in terms of the beliefs of the speaker/addressee and the content of the common ground. For American English, I will argue here for the position that the nuclear tune has intrinsic meaning and, moreover, that it can be represented formally in semantics (albeit in update semantics, which is very "pragmatic"). In particular, rising nuclear tune will be analyzed as an expression of epistemic uncertainty, a kind of intonational adverb like *'possibly'*. The proposal will also directly link the linguistic contribution of intonational features to their paralinguistic overtones, in that the attitudes associated with the use of rise (uncertainty, conduciveness, insecurity, submissiveness, etc.) can be derived from the epistemic uncertainty interpretation. The intonational meaning will be assumed to interact with the meaning of other lexical items on the same level and it will be kept constant both in the production and the perception process.

Since rising intonation is often assumed to be questioning, a large part of the

investigation described here concerns questions. Although the term 'question' is frequently used both in- and outside of linguistics, no definition exists that could be used as a basis for a question identification procedure in conversational corpora. A part of the problem is that speakers' intuitions about which utterances are questions significantly differ, once non-interrogative and syntactically incomplete examples are taken into consideration. In fact, it appears that speakers themselves are often unsure how they would classify their own utterances. For this reason, some authors have argued that the distinction between questions and assertions should not be viewed as a categorical one, but as a continuum, where utterances can be more or less questioning/asserting. Here, I will try to maintain the categorical interpretation of questions and assertions. The term 'question' will be used solely for the semantic object denoted by interrogatives and I will employ the description "response-seeking" for utterances which are followed by a response but do not necessarily have an interrogative form. The type of response expected by the speaker can vary from a simple acknowledgment to an evaluative response in the sense of Clark's "ladder" ([Clark, 1996]). Crucially, all response-seeking declaratives will be analyzed as assertions , though some of those requiring an evaluative response (e.g., so-called rising declaratives) will be considered weakly assertive, in the sense that they contain an expression of speaker's epistemic doubt. It will be argued that the fact that weakly assertive utterances often receive a response is due to principles of rational conversation in the sense of [Grice, 1975]. In general, in the proposal defended here, the relation between syntactic types and the semantic objects they denote will be direct, in that all declaratives will be interpreted as assertions and all interrogatives as questions.

With respect to the intonational features themselves, although the distinction between rising and falling intonation is very basic, many different definitions of the term 'rise' can be found in the literature. Some authors consider as rising all tunes that end with a high boundary tone while others only those that are non-falling from the last pitch accent and end higher than the pitch accent itself. Different types of rises can be distinguished, e.g., the high rise and the low rise already mentioned above. In the empirical studies of American English performed as a part of the research reported in this thesis, several definitions of the final rise were tested. The set of tunes (described with a broad ToBI alphabet and based on Gunlogson's definition ([Gunlogson, 2001])) that is subsequently assigned a specific semantics, is the set that was most frequently associated with the evaluative-response-seeking interpretation by listeners. The same set of contours was also linked to a particular type of bias in the case of polar interrogatives. Both these findings were taken into consideration when formulating the semantic proposal presented in chapter 5.

As already remarked above, the association of rises with questions, assumed to be universal on the basis of the biological production of pitch, does not hold across languages and even language-internally, yet intuitively, speakers perceive it that way. With the proposal made here for American English, the link be-

tween rises and evaluative-response-seeking assertions is explained as an effect of a third variable. In other words, the indirect association between the *Frequency Code* and "questioning" is preserved. The direct linguistic interpretation assigned to the final rise is, on the other hand, a more or less exact interpretation of the paralinguistic content of the code (uncertainty, submissiveness etc). Given the presupposed universal status of the biological codes, the issue then arises whether the same explanation applies to other languages besides American English. In chapter 6, I will examine the use of final rise in Standard French. The results of a corpus study described there indicate that while rises and questions in this language also do not always go hand-in-hand, it is not because of the same reason as in American English. In particular, one finding of the study is that the correlation between rises and topic introduction in discourse is stronger than the correlation between rises and questions. This fact, in turn, suggest that another biological code is operative, namely the Production Code. However, given that the methodology used in the French study differed from that employed for American English and that different results have been reported in the literature, the comparative findings will be interpreted as tentative.

Finally, an explanation should be offered regarding the choice of languages examined in this thesis. As indicated in earlier sections of this chapter, empirical research in intonation is difficult without access to large conversational speech corpora, as well as to a sufficient number of native speakers able to participate in experimental tasks. The first criterion, in fact, significantly narrows down the research choice because transcribed conversational speech corpora are available for only a few of the world's languages. Among these, English has been most frequently studied from the point of view of intonational meaning and it thus offers a rich ground for examining theories and their predictions. The known empirical results also make it easier to formulate a theoretical proposal. Furthermore, English and French appear to use intonation on utterance level in a similar way, which makes a comparison between them simpler.

2.7 Summary

In this chapter, I first introduced very basic linguistic notions such as *prosody* (suprasegmental properties of the speech signal, like fundamental frequency ($F0$), intensity, duration, pauses and voice quality), *intonation* ($F0$ and intensity), segments in the *prosodic hierarchy* (syllables, feet, phonological words, accentual phrases, intonational phrases and, on the very top, utterances) and *nuclear intonational phrases* with *nuclear pitch accents*. The introduction served to clarify the use of these terms in the chapters to follow, given that different definitions can be found in the literature. More detailed descriptions of prosodic features can be found in foundational texts such as [Bolinger, 1986] and [Bolinger, 1989], [Cruttenden, 1997], [Crystal, 1969], [Gussenhoven, 1984] and [Gussenhoven, 2004],

[Hirst and DiCristo, 1998], ['t Hart et al., 1990], [Pierrehumbert, 1980], as well as [Ladd, 1996].

With respect to the use of intonation, it was noted that in all languages, intonation can express paralinguistic meanings, but as for its linguistic functions, languages exploit intonation in different ways. For example, some of them use pitch patterns for lexical and/or part-of-speech distinctions, while in others (e.g., in American English and Standard French, examined here) it presumably mainly operates on discourse level to encode types of discourse moves and information structure units. In an original way, Gussenhoven's proposal attempts to link the paralinguistic and linguistic interpretation of some intonational patterns on the biological basis of their production.

Two main types of intonational descriptions were distinguished, based on *auditory* and *instrumental analysis* of the speech signal. It was argued that auditory analysis which relies purely on the perceptual impression of the listener is often unreliable; instrumental analysis, on the other hand, makes use of pitch tracking software which represents the acoustic properties of the signal but not directly its perceptual properties. Both auditory and instrumental analysis are normally used to annotate the relevant properties of the pitch contour. Different annotation standards were mentioned and two of them – MAE-ToBI and INTSINT – were described in more detail. Regarding the collection of intonational data, some arguments were given for the use of real conversational speech data (including in experimental tasks) over artificial examples, which may not be ecologically valid.

The theoretical approaches to the linguistic meaning of intonation were classified into 'statistical' and 'rule-based'. In the first group, the work of Mushin et al., Fletcher et al. and Kowtko were discussed, all of them focussing on the association of tunes with certain discourse units (moves). In the second group, the approaches of Gussenhoven, Pierrehumbert & Hirschberg, Merin & Bartels, Gunlogson, Steedman and Marandin et al. were briefly described; all of them shared the assumption that intonational meaning is compositional and that it is related to the beliefs of conversational participants regarding the truth of the expressed proposition and the content of the common ground.

Finally, the research position that will be assumed and defended in this thesis was outlined.

In the next two chapters, I will describe the use of rising and falling intonation in declaratives and interrogatives in American English, starting with an overview of the existing literature and some experimental results regarding the interpretation of the term 'question' by native speakers of American English.

Chapter 3

Rising and falling declaratives

3.1 Introduction

In this chapter I focus on the meaning of what has in the past been called a 'question contour'. It is often assumed that there exists a contour in English (but also in other languages) which helps to distinguish questions from statements. If so, this fact would offer a persuasive argument in support of the view that intonation can be directly associated with grammatical functions. Moreover, once the intonational characteristics of the 'question contour' are identified, it would be relatively simple to describe them in formal semantic terms. The sum of previous claims that can be found in the literature, however, offers an inconclusive picture both with respect to whether there is a typical question contour and what intonational features are associated with it.

I first review the results of the past approaches and, on their basis, formulate several research issues. In this chapter and the following, I present results of experimental and corpus studies, starting with an investigation of the term 'question' itself. The results of a task designed to test native speakers' intuitions suggest that the understanding of the term widely differs. This finding possibly casts doubt on the interpretation of existing experimental results which presuppose that speakers' use of the notion 'question' is uniform. One possible explanation for the diversity of interpretations is that the semantics of interrogatives gets confused with the pragmatic effect of utterances that receive a response from the addressee. Therefore, in what follows, I have decided to utilize the term 'question' only in reference to the semantic object denoted by interrogatives (viz. chapter 4 and 5). To describe declarative utterances which in their context receive a reply, the term 'response-seeking utterances' will be employed instead. Some criteria for identifying (two types of) response-seeking declaratives in spoken corpora will be suggested and used to extract data from a conversational corpus. The corpus examples will subsequently be used in an experiment designed to test the association of evaluative response-seeking with intonational contours. Based on claims

that can be found in the literature, several possibly relevant intonational features will be tested. A set of three nuclear tunes, identified by [Gunlogson, 2001] and described with broad ToBI notation will be selected as the best predictor of the evaluative response-seeking interpretation.

I will argue that the experimental results presented in this chapter support the hypothesis that intonation plays a role in recognition of evaluative response-seeking utterances, though it is neither *sufficient*, nor *necessary*. The rising contours associated with this function can also be found in pure assertions, and utterances can have an evaluative response-seeking effect even when they are rendered with falling pitch. As far as I can see, there are two ways to deal with this kind of result. One is to maintain the view that certain intonational features are, in fact, evaluative response-seeking, but for other reasons, they are not always present on evaluative-response-seeking utterances. This is a view that is in accordance with the assumption that intonational meaning is weak or non-intrinsic and I will argue against it on empirical grounds. The other possible explanation, which I will advocate here, is that these intonational features have a fixed semantics and their association with evaluative response-seeking is indirect. At the end of this chapter, I will offer a brief sketch of the semantic proposal which will be developed in detail in chapter 5.

3.2 Literature Overview

According to the popular view, "by finishin[g] a sentence with rising intonation, we can create a yes-no question" (as expressed by [Nakajima and Allen, 1993]:198) and empirical evidence from corpus and experimental studies seems to support this view. Cross-linguistically, *yes/no*-questions are reported to be associated with a 'rising contour', 'presence of a high pitch' and/or a 'high boundary' (a.o., [Armstrong and Ward, 1926], [Bolinger, 1978a], [Ultan, 1978], [Ohala, 1983] and [Ohala, 1984]; for American English, e.g., [Uldall, 1964], [Lieberman, 1967], and older references in [Fries, 1964]).[1] Perceptual experiments with laboratory speech confirm that speakers tend to associate rising contours with questionhood. For example, in a phonetic study, [Hadding and Studdert-Kennedy, 1972] tested what stimuli get classified as questions in American English and found that the higher the terminal rise, the higher the percentage of question responses (though other factors, such as the $F0$ value preceding the final tone, also play a role). Somewhat peculiarly, Hadding & Studdert-Kennedy (*ibid*) also report that speakers tend to associate what they think is a question with a terminal rise, even when the contour is actually falling, and *vice versa* for statements.

One difficulty with the reported observations lies in the notion of 'question' and its interpretation. In particular, it is not clear how individual participants in

[1] Interestingly, Uldall [Uldall, 1964] also reports that the neutral intonation for statements was rising to mid pitch in her data set (as opposed to rising to high for questions).

the studies above actually understood the term and whether or not they would agree on their interpretation. In fact, it is not obvious how best to define the term 'question'. Some researchers assume that a question is any utterance to which a speaker received or expected to receive a response (e.g., [Geluykens, 1988]). From another perspective, that definition may be too broad because many statements receive a confirmative feedback from the addressee (as in (1-d), adapted from the Santa Barbara Corpus).

(1) a. A: *in other words I should change filters*
b. B: *ugh God*
c. A: *I know it won't last long but it sure does make a mess in the house*
d. B: *yeah it makes a mess*

Other utterances, to which a response or a kind of feedback is expected are the imperative in (2-a) or the embedded question in (2-b), which have almost the same effect as (2-c). In a conversation, all these utterances have the effect of a request for information, but their syntactic type and, presumably, prosodic properties would differ.

(2) a. *Tell me everything!*
b. *I would like you to tell me everything.*
c. *Can you tell me everything?*

The term 'question' may also be interpreted as "a sentence ending with a question mark".[2] In general, though, speakers appear to experience some doubts if inquired about their understanding of the notion. Grundstrom, in an experiment on the question status of utterances [Grundstrom, 1973]:37 notes that, upon reflection, his subjects had little confidence regarding their judgments and one of them noted that "the notion of 'interrogativity' is not very clear".[3]

Another difficulty with the results of the perceptual experiments, confirming speakers' interpretation of rising utterances as questions, is that they are not mirrored in production studies. As discussed briefly in chapter 2, it has been noted that in American English, there are questions without rises and rises without questions ([Pike, 1945], [Fries, 1964], [Crystal, 1969], and [Bolinger, 1982] and [Bolinger, 1998]). Corpus studies show that 40-60% of *yes/no*-questions and 60% of *wh*-questions are falling ([Fries, 1964], [Stenström, 1984], [Hirschberg, 2000]); the most extreme result being that of [Fries, 1964] who reported that in his corpus, of 2561 *yes/no*-questions, 1580 had falling intonation, i.e., 61.7%, and only

[2]In January 2005, a group of English undergraduates at the University of Toulouse - Mirail was presented with a dialogue transcript where some declaratives ended with a question mark and asked, *disregarding the punctuation signs, is the utterance X a question or not?* Some offered the response "no, because without the question mark the utterance cannot be a question."

[3]Grundstrom concludes that in some cases, even the speaker herself can be uncertain whether her utterance is a question or not, and that the distinction between a question and an assertion is not obligatory in some languages. I will not advocate this particular view here.

38.3% were rising.[4]

If rising intonation does not always co-occur with questions, does this necessarily mean that it is not used as an indicator of questionhood? One could argue that the role of rising intonation is only to help the question interpretation in ambiguous cases. This is an assumption that [Haan, 2002] formulates in terms of her *Functional Hypothesis*. The hypothesis predicts that high or rising pitch will be maximally present in questions that are not otherwise marked for interrogativity (i.e, declarative questions), somewhat less in questions with inversion, and least in questions with both a question word and inversion.[5] Haan's experimental research confirms the hypothesis for Dutch: all the declarative questions in her corpus were rendered with a rising pitch. The corpus, however, consisted of isolated read examples provided with clear punctuation, i.e., utterances, which are not likely to be representative of the patterns found in natural conversations. Moreover, since all the declarative questions ended with a question mark, it is possible that speakers interpreted it as a request to use rising intonation. Also, as already noted in chapter 2, read speech in general differs from conversational speech and, in fact, Haan's results differ from those found for Dutch dialogues. In particular, Beun ([Beun, 1989], [Beun, 1990]) notes that in his corpus of natural dialogues, about 20% of declarative questions were falling and could often be identified by second person personal pronouns, an expression of uncertainty and/or particles like *en* ('and'), *dus* ('so') or *ook* ('also') at the beginning of the utterance. Beun's results are in line with the outcome of an experimental study by [Geluykens, 1987] for British English, who found that some utterances with a declarative syntax are more question-like than others, because they concern information about internal states of the addressee. For example, a sentence like "You feel ill" will usually have an interrogative intent, while "I feel ill" is more statement-prone, as the speaker is not likely to question his or her own feelings. (This difference is also discussed by Le Nestour (1978), as cited by [Kerbrat-Orecchioni, 1991]:92 who calls predicates that denote intimate experiences "auto-cognitive" and the opposite "hetero-cognitive".) Furthermore, Geluykens determined that the relative cue value of artificially provided rising intonation as a marker of questions depends on the lexical-pragmatic properties of the utterances. In follow-up studies using spontaneous speech corpora of Southern British English, [Geluykens, 1988] reports that a majority of declarative questions in his corpus occurred with a fall (57%

[4]Like with the experimental studies discussed previously, however, also corpus studies face the problem of defining questions. In fact, it is crucial for the interpretation of their results to know what procedure was employed for question identification (but the procedure is not always specified).

[5]One could question the basis of the Functional Hypothesis as such, since inversion and the presence of a *wh-* word are not an unambiguous marker of interrogativity (as noted by Haan herself): in English, exclamations can contain either; in Dutch, there are exclamations with both a *wh-*word and syntactic inversion. On the other hand, it has been argued that exclamatives as a category are orthogonal to the category of interrogatives and declaratives (viz. [Fónagy and Bérard, 1973]).

of the data, comparably to the overall frequency of falls - 64%). He concluded that intonation is "virtually irrelevant as a question cue" [Geluykens, 1988]:479 and that lexical-pragmatic indicators are more important for determining the question status of an utterance. The role of context is clearly important, too, including body language (especially facial expressions such as eyebrow raises or "puzzled look"); as found by [Léon and Bhatt, 1987], most utterances perceived and treated as questions during conversations are not identified as such in isolation (in their corpus, 13 out of 50). To conclude, Haan's results are not supported by results of other existing studies, both for Dutch and other languages. On the other hand, the *Functional Hypothesis* itself is not so obviously disproved if we assume that there are other question cues apart from inversion and the presence of a *wh*-word. In this way, one could maintain that intonation is used as a question cue for utterances which are not morphosyntactically and/or contextually unambiguous. Even the enriched *Functional Hypothesis*, however, does not deal with the fact that rising intonation also appears on assertions, which can be viewed as a disadvantage if one is aiming for a unified account of its function.

Many dialects of English exhibit the use of rising intonation on statements (so called 'high rise terminals', 'uptalk', or 'recurrent intonational rises'). This phenomenon had until not long ago been delegated to the realm of sociolects (it is still sometimes referred to as "valley-girl speech" or "mallspeak") but the developments of the last fifteen years and observations from other English varieties do not justify this categorization.[6] American English uptalk has been described most extensively by [McLemore, 1991b] and [McLemore, 1991a] in her corpus study of sorority speech and in some recent popular articles (e.g., [Seaton, 2001]) which indicate that rising statements have become a feature of General American English (for a smaller, related study, see [Hirschberg and Ward, 1995]). This appears to be the case also for other English varieties: [Fletcher and Harrington, 2001] note that both for Australian English and for New Zealand English,[7] the tune has been adopted by a broad cross-section of the community of speakers. In general, it serves to express a number of functions, such as checking whether the audience has understood what is being said ([Guy and Vonwiller, 1989]), maintaining speaker-hearer solidarity ([Warren and Britain, 2000]), marking politeness[8] and as an expression of tentativeness which allows the speaker to retract the statement if it is met with criticism or disapproval ([Seaton, 2001], [Pierrehumbert, 1980]). In fact, apart from questioning, final rises in English have been linked to a number of other meanings. With respect to their attitudinal features, they have been characterized as indicators of non-conduciveness and expressions of reservations and a conciliatory attitude ([Cruttenden, 1981]); experimental research shows

[6] Rising intonation on statements also exists in other languages that otherwise typically have falls, e.g., Finnish, or French, discussed in more detail in chapter 6.

[7] However, there are differences in the use of the rise in Australian English and in American English, as discussed below.

[8] Uldall [Uldall, 1964] notes that polite statements in Swedish also often end in a rise.

that rise is perceived as a signal of friendliness, uncertainty, submissiveness and pleasantness ([Uldall, 1964], [Chen and Gussenhoven, 2003], [Chen et al., 2001]). [Gussenhoven, 2002a] and also [Merin and Bartels, 1997], following [Ohala, 1983] and [Ohala, 1984], consider these to be paralinguistic meanings of questioning but as contended in chapter 2, there are reasons to doubt this interpretation because questions have a strong imperative component. To sum up, any description of the meaning of rising contours in English has to account for their presence on both questions and statements, and for other meanings associated with them, an explanation which the *Functional Hypothesis* does not appear to provide.

Regarding the shape of the contour presumably associated with questions, a number of existing studies deal with its phonetic properties, such as the $F0$ value at onsets and terminals, pre-final peaks and turning points, (lack of) final declination etc. (e.g., [Hadding and Studdert-Kennedy, 1972] for English and Swedish and [van Heuven and Haan, 2000] and [Haan, 2002] for Dutch). However, for spontaneous conversation speech, exact acoustic properties are difficult both to measure and to generalize over, given large inter- and intra-speaker variation in $F0$ values. In what follows, I will focus mainly on phonological descriptions, in particular those that use some version of MAE-ToBI.

Different claims regarding the ToBI description of the "question contour" can be found in the literature, some of which was already mentioned in chapter 2. [Pierrehumbert and Hirschberg, 1990] suggest that questions are typically realized as L* H- H%, while [Bartels, 1999] argues that not only L* H- H%, but also L* H- L%, H* H- H% and H* H- L% are "non-assertive"; in the terminology of [Merin and Bartels, 1997], they alienate choice over the status of the expressed proposition to the addressee. [Steedman, 2004a], [Steedman, 2004b] suggests that only boundary tones are crucial with respect to speaker's or hearer's commitment, in particular, H- H% and L- H% express hearer's commitment (and are thus presumably associated with questions) while L- L% and H- L% express speaker's commitment (and are presumably associated with assertions). Finally, [Gunlogson, 2001] defines question intonation as "non-falling from the nuclear pitch accent to the terminus and ending at a point higher than the level of the nuclear accent", a description which, according to her, fits the tunes H* H- H%, L* H- H%, L* H- L% and L* L- H% in the ToBI notation.

Apart from associating rises with questions and a number of attitudes like uncertainty, politeness and others, there is also a strong tradition of interpreting rises as signaling 'openings' or incompleteness (and falls signaling 'closings' and completeness) which can be traced back to the Prague Linguistic Circle ([Sgall et al., 1986], [Hajičová et al., 1998]) and the terms *anti-cadence* and *cadence*, respectively ([Karcevskij, 1931]), an its interpretation may also be found in the work of [Pierrehumbert and Hirschberg, 1990], [McLemore, 1991a], as well as [Cruttenden, 1997]. [Ladd, 1981a] ascribes this view to what he calls 'The Strong Universalist Hypothesis' and formulates it as follows:

> Phrasing and sentence-types are signaled primarily by high or rising pitch at the end of incomplete or unresolved phrases or utterances, and low or falling pitch at the end of complete or final ones, resulting from either sustained or reduced muscular tension which again reflect the speaker's intention either to continue or to stop. The use of high or rising terminals for "question intonation" signals incompleteness or lack of resolution at the discourse level, with one speaker inviting resolution (i.e. response) from the other speaker.
>
> [Ladd, 1981a]:389

An example of a rise signaling incompleteness is the so-called continuation rise (a turn-internal rise). An example from [Pierrehumbert and Hirschberg, 1990], is given in (3), involving anaphora resolution. With a rise on *it's quite annoying*, the referent of the pronoun *it* is *my spending two hours figuring out how to use the jack*, whereas in (4) with a rise on *my new car manual is almost unreadable*, it is likely to be interpreted as *my new car manual*.

(3) a. *My new car manual is almost unreadable*$_{L-L\%}$
b. *It's quite annoying*$_{L-H\%}$
c. *I spent two hours figuring out how to use the jack*$_{L-L\%}$

(4) a. *My new car manual is almost unreadable*$_{L-H\%}$
b. *It's quite annoying*$_{L-L\%}$
c. *I spent two hours figuring out how to use the jack*$_{L-L\%}$

The interpretation of the rise formulated in the 'Strong Universalist Hypothesis' is, however, by no means straightforward: At least in British English and Dutch (though not in French, it seems), the distinction between (turn-final) "question rises" and (turn-internal) continuation rises appears to be reflected intonationally. In particular, the continuation rise is 'non-falling' rather than rising (viz. [Caspers, 2003] for Dutch, [Wichmann and Caspers, 2001] for Southern British English, and the discussion by Post [Post, 2000]). In the ToBI terminology, the difference between a non-fall and a rise would translate into one between a final (high) plateau transcribed as a low boundary tone, L% and a final rise, transcribed as a high boundary tone, H% (cmp. figure 3.1 with an upstepped boundary tone and figure 3.2 with a high rising boundary).
As a matter of fact, there is another example of a turn-internal rise which indicates that the speaker's utterance has not ended, namely the 'comma intonation'. As observed by Ladd, at least in English, the comma intonation is a fall-rise, rather than a simple rise, as in the example in figure 3.3.[9]

[9]Ladd (*ibid*) also gives examples of simple rises before comma pauses used in contexts where what follows the comma is "expected or formulaic" - I assume that these are cases of continuation rise described in 3.1.

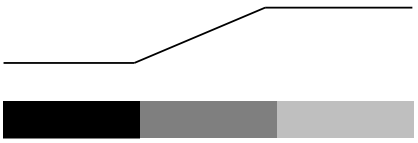

Figure 3.1: Continuation rise: an upstepped low boundary (L*H-L%).

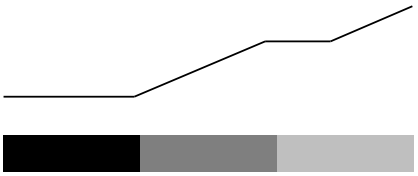

Figure 3.2: Turn-final rise: a high rising boundary (L*H-H%).

To sum up, in this chapter so far, I offered an overview of the existing literature regarding question intonation. It was noted that while perceptual studies show that listeners interpret rising intonation as questioning, production (corpus) studies do not confirm this result. For both types of research, however, it is crucial to know how listeners/corpus annotators used the term 'question', as it can be understood in a number of significantly different ways. I argued against a possible way to reconcile the different perceptual and corpus results in terms of the *Functional Hypothesis*, according to which question intonation is necessarily present only on those utterances that could otherwise be misinterpreted by the listener. The main counter-argument to the hypothesis in American English is the existence of uptalk, i.e., assertions with question intonation. With respect to the exact shape of the contour associated with questions, four different claims cast in the ToBI notation were presented. Finally, a possible connection between the question intonation and the continuation rise was established, formulated in terms of the 'Strong Universalist Hypothesis'.

In the next section, I will focus on the issue of how native speakers of American English interpret the term 'question'.

Figure 3.3: Comma intonation in English, as reproduced from Ladd [Ladd, 1981a].

3.3 What is a 'question'?

In this section I will first present the results of an experiment designed to test native speaker judgments about which utterances in a conversation qualify as questions. The experimental hypothesis was formulated as:

The term 'question' is used in a uniform way by native speakers.

One of the goals of the experiment was to use native speakers' intuitions (if sufficiently uniform) to establish a workable procedure for question identification in conversations. The intended purpose of the procedure was to collect questions from a corpus in order to examine their intonational patterns. Since the questions have to be collected without reference to their intonational properties (to avoid bias), only conversational transcripts can be used in the identification process. Therefore, judges in the experiment were only presented with a transcript of a free conversation, with no access to its audio recording.

Method

Participants
The participants in the study were 26 native speakers of American English, 13 male and 13 female, between 24 and 67 years old. Some of them were contacted directly and some of them were recruited by their departmental colleagues or via the [phonlist], a phonetics email list. They were paid for their participation in the task with an Amazon gift certificate for $15. The task was estimated to take between 15-20 minutes, though some of the judges reported that they needed more time.

Material and procedure
The task was set up as a web form with an accompanying `php` script for input submission. A transcript of a natural free conversation, publicly available from the Santa Barbara Corpus, part I, was segmented into individual meaningful units assumed to correspond to utterances, with 875 utterances in total. The original punctuation used by the conversation transcribers was removed from the text. There were three speakers in the conversation, all female, referred to as Lynne, Lenore and Doris in the transcript. Their individual contributions were highlighted with different colors (red, blue and green) in order to help the

judges process the text. Each utterance started on a new line and finished with a "checkbox". The participants received the following instructions:

> *Below is a transcript of a real conversation. Check the box next to the utterance you think was a question.*

Prior to the actual task, the judges were asked to submit their name, email, age and gender. Submitting their name and email was necessary for the participants to receive their Amazon gift certificate. The information about their gender and age was considered of possible relevance for the evaluation of the responses.

Results

Speakers' responses were first evaluated in terms of general agreement. There were in total 218 cases classified as questions by at least one judge. Of these, one fifth (19.5%) was classified as questions by more than a half of the judges; on the other hand, one fifth (20%) of the utterances identified as questions were identified by just one judge. There were 6 utterances that were identified as questions by *all* the judges: these were all isolated utterances of just a *wh*-word (such as *what, why*) or a *wh*-word with a part of the predicate (e.g., *where is the uh...*) or with subject-finite verb inversion (e.g., *did they train you that...*). Overall, more than 60% of the utterances categorized as questions were so interpreted by five or less of the 26 judges. The distribution of answers is summarized in table 3.1 below.

A brief analysis of the responses revealed that some apparent points of disagreement were:

1. *you know*-**phrases**: These were prevalent in the speech of one of the recorded speakers (Lynne) who also contributed longer monologues into the conversation. Some judges always marked the phrases as questions, others did so only if they were turn-final and some judges never considered them to be questions.

2. **uncertainty expressions**: Some judges classified expressions of uncertainty as questions, e.g., (5) or (6), similarly also (7-b) and, possibly, also (8-b):[10]

   (5) *I wonder if that has something to do with it*

   (6) *maybe it is, maybe it is*

   (7) a. LYNNE: *so she named everybody in the class except for*
   b. LENORE: *about four people – well I think they asked for names*
   c. LYNNE: *oh did they*

[10]It is not clear whether (8-b) was interpreted as expressing uncertainty or was a misunderstanding.

Table 3.1: The overall distribution of judgments for utterances classified as questions.

Nr. of judges	Nr. of cases	Proportion
1	42	.19
2	17	.08
3	28	.13
4	24	.11
5	22	.10
6	12	.055
7	7	.03
8	6	.025
9	4	.02
10	4	.02
11	7	.03
12	0	0
13	4	.02
14	0	0
15	1	.005
16	4	.02
17	2	.01
18	5	.02
19	3	.015
20	9	.04
21	1	.005
22	1	.005
23	2	.01
24	3	.015
25	4	.02
26	6	.025
Total	218	1

(8) a. LYNNE: *he's a pretty neat guy I thought*
b. LENORE: *yeah*

3. **imperatives**: Some judges classified also imperatives, as in (9), as questions:

(9) *look right here*

4. **hidden questions**: Utterances that were used to elicit a response, as in (10) where the speaker is asking a direct witness of an event for a confirmation of information she received, were sometimes classified as questions.

(10) *and she said like the lights looked a greenish color*

5. **incomplete utterances**: Utterances with ellipsis or requests for confirmation such as (11) were a frequent source of disagreement, in that some judges identified them as questions, while others consistently excluded them.

(11) *really*

(12) *Debby*

(13) *in Roundup*

6. **rhetorical questions**: Some judges classified rhetorical *wh*-questions as questions.

The responses were evaluated in a pair-wise comparison using the Cohen's κ coefficient [Cohen, 1960], where zero corresponds to an agreement between two judges which was the same as chance. The statistic is calculated on the basis of a two-by-two table, where A is the number of utterances both subjects considered to be questions, B, like C, is the number of utterances which had this property according to one of the judges but not according to the other one, and D is the number of utterances on which the two judges agreed that they were not questions. Obviously, $A + B + C + D = N$, N the total number of utterances (i.e., 875).

	Q for judge$_1$	Non-Q for judge$_1$	Total
Q for judge$_2$	A	B	$A + B$
Non-Q for judge$_2$	C	D	$C + D$
Total	$A + C$	$B + D$	N

$$\boxed{\kappa = \frac{2(AD-BC)}{(A+C)(C+D)+(B+D)(A+B)}}$$

The strength of agreement, measured with the *kappa*-statistics, is often described verbally with the Landis-Koch scale [Landis and Koch, 1977], as: < 0 - "poor", $0-.20$ - "slight", $.21-.4$ - "fair", $.41-.6$ - "moderate", $.61-.80$ - "substantial" and $.81-1.0$ - "almost perfect" (though some statisticians oppose this interpretation).

The *kappa*-statistic, though widely used, is sometimes disputed as the appropriate measure of inter-rater agreement [Ciccheti and Feinstein, 1990]. Therefore, additional measurements of agreement were made, using raw agreement indices: the observed proportion of overall agreement (which, unlike κ, does not correct for chance), symbolized here as p_o, and the proportion of specific agreement for positive and negative ratings, ${p_s}^+$ and ${p_s}^-$ respectively. Given that the conversation transcript contained proportionally a much larger number of utterances overall classified as non-questions, especially the positive rating ${p_s}^+$ was of relevance. The formulas for calculating the raw agreement measurements are given below:

$$\boxed{p_o = \frac{A+D}{A+B+C+D} = \frac{A+D}{N}}$$

$$\boxed{{p_s}^+ = \frac{2A}{2A+B+C}}$$

$$\boxed{{p_s}^- = \frac{2D}{2D+B+C}}$$

The κ coefficient and the raw agreement measurements were calculated for all pairs of judges (for 26 judges, 325 pairs) on their compared scores, using an `awk` program, and evaluated in SPSS. Cohen's κ coefficient varied from 0.15 to 0.82, with the mean κ being 0.52 (S.D.=.139), which is taken to correspond to 'moderate' on the Landis-Koch scale ([Landis and Koch, 1977]). The proportion of overall agreement varied between 0.36 and 0.99, with the mean 0.94 (S.D.=.568); the agreement on positive ratings varied between 0.19 and 0.99 with the mean 0.55 (S.D.=.137) and the agreement on negative ratings varied between 0.92 and 0.99 with the mean 0.96 (S.D.=0.018).

Although the κ coefficient and the raw agreement scores can give an overall impression of subjects' agreement in the task, a more detailed statistical analysis is needed to determine the difference in underlying models speakers used to identify questions in the task. For this purpose, all the utterances were tagged for the presence/absence of seven categorical features estimated to play a role in the subjects' decision process. The description of the features is summarized in table 3.2.

The feature **uncertainty** was present for utterances that contained one of the following phrases: *I guess, I wonder, I forget, I don't know, maybe* and/or *perhaps.* These were considered to express the uncertainty or ignorance of the speaker; the

Table 3.2: Features estimated to play a role in judgments of question identification.

inversion	(Y/N)	subject-finite verb inversion in the (main) clause
uncertainty	(Y/N)	contains an expression of uncertainty
question test	(Y/N)	if turned into an interrogative, would be felicitous in context
wh-word	(Y/N)	a *wh*-word in the utterance
turn final	(Y/N)	turn-final
you know	(Y/N)	*'you know'* in the utterance
yes/no-answer	(Y/N)	followed by a *yes/no*-reply

list is based solely on expressions of uncertainty found in the transcript. The feature **question test** was present for a declarative utterance which, if turned into an interrogative by a simple subject-finite verb inversion in the main clause, still appeared to be felicitous in their context (see also below for examples and further discussion of this feature). The annotation of the utterances was done by a single annotator, which may be problematic for the feature **question test** given that it involves a subjective judgment. The features **wh-word**, **you know**, **turn final** and **uncertainty**, on the other hand, were identified mechanically with a simple matching procedure. The same could be done for the feature **yes/no-answer**, selecting utterances immediately followed by *yes/no/mhmm/yeah* (here, also responses that contextually entailed *yes/no* were taken into consideration). The feature *you know*, apart from being one of the sources of obvious disagreement about subjects, was assumed to represent clear hetero-cognitive predicates.[11]

The features were inspected for possible dependencies with a χ^2 analysis; for cases where more than 20% of the expected frequencies were below 5 or one of them below 1, Yates' correction was employed. The calculations were done with an online calculator at `www.unc.edu/~preacher/chisq/chisq.htm`. The analysis revealed a statistically significant association in eight cases out of the twenty-one possible ones and in these cases, the effect of a factor (as described below) thus cannot be ascribed uniquely to its presence but has to be considered together with its dependencies. The presence of an uncertainty expression was frequently accompanied with the presence of a *wh*-word, with ${\chi^2}_{(1)} = 33.506$, $p < .01$, an effect which can be explained by the frequent embedding of *wh*-clauses under the predicates *I don't know, I forget* and *I wonder*. Turn-finality was significantly associated with all the other features, except for **uncertainty**, with, for the pairs **wh-word** – **turn-final, yes/no-answer** – **turn-final, inversion** –

[11] Other instances of predications of the *second person singular* were more problematic. One of the speakers (who contributed longest monologues) frequently used the expression in the generic sense which cannot be counted as hetero-cognitive. There were also many cases for which it was not clear whether or not the predicate is understood to be hetero-cognitive.

turn-final, question test – **turn-final, you know** – **turn-final**, respectively, $\chi^2_{(1)} = 10.839$, $p < .01$; $\chi^2_{(1)} = 177.509$, $p < .01$; $\chi^2_{(1)} = 16.701$, $p < .01$; $\chi^2_{(1)} = 25.690$, $p < .01$; $\chi^2_{(1)} = 23.468$, $p < .01$. The presence of a *wh*-word was not independent of inversion, with $\chi^2_{(1)} = 59.020$, $p < .01$ and, finally, inversion was not independent of the **yes/no-answer** feature, (as could be expected, since interrogatives are frequently followed by a *yes/no* answer), with $\chi^2_{(1)} = 21.880$, $p < .01$.

In order to determine the role of the seven features as factors in speakers' individual, as well as combined responses the data were analyzed with logistic regression in SPSS 11.0.3, with 'question' as the dependent (binary) variable and the seven features as categorical predictors. For all subjects, their models were significant (the null hypothesis being that no utterance is a question), but there were individual differences with respect to the significance of the different features (viz. table C.1 in the appendix). For example, while many judges considered the feature **inversion** to be the most important for question identification, for other judges it was rather the fact that an utterance contained the *'you know'* phrase or that it contained a *wh*-word or could in the context be turned into an interrogative (the **question test** feature). The **uncertainty** feature was not significant in any of the individual models.

Following the individual analyses, the responses by all twenty-six subjects to the 875 utterances were merged together, thus giving 22 750 cases and evaluated with the logistic regression analysis in SPSS 11, using the seven binary features as before. The purpose of the analysis was to identify features relevant for question identification across subjects.

With the null hypothesis that all utterances are not questions, which could account for 93 percent of the responses, the model with the seven features could account for 94,2 percent of the responses, correctly identifying 38,1 percent of utterances subjects classified as questions (compared to 0 percent based on the null hypothesis). The model was significant with $\chi^2_{(7)} = 4537.340$ and p< .01. The importance of the individual features, which were all significant, is summarized in table 3.3.[12] The results reveal that in the general model, the two most important factors for question classification were inversion and the presence of *'you know'*, while the presence of an uncertainty expression, though significant, was not as important as any of the other factors.

In the logistic regression analysis described above, as questions in the model were considered all utterances that were so classified by at least one judge. Since there was a large amount of disagreement between subjects, the results were

[12]In the table, **B** expresses the value for predicting the dependent variable based on the independent variable calculated with logistic regression, **S.E.** are standard errors associated with the coefficients, **Wald** provides the Wald χ^2 value, **df** stands for the number of degrees of freedom, **Sig.** for significance level and **Exp(B)** conveys the odds ratios of the predictors. Features with the lowest value of B/Exp(B) are the best predictors in the model (if significant, given some previously established significance level).

Table 3.3: Importance of individual features in a model for merged responses.

	B	S.E.	Wald	df	Sig.	Exp(B)
uncertainty	2.935	.394	55.472	1	<.01	18.820
you know	-3.101	.095	1070.196	1	<.01	.045
wh-word	-2.200	.095	538.719	1	<.01	.111
yes/no-answer	-1.462	.099	216.404	1	<.01	.232
inversion	-3.534	.128	767.614	1	<.01	.029
question test	-1.525	.122	156.176	1	<.01	.218
turn final	-2.025	.092	481.178	1	<.01	.132

also analyzed from the perspective of the majority opinion. Again, the logistic regression analysis on all results was performed, but this time, only utterances that were categorized as questions by more than half of the judges (i.e., more than 13) were considered as questions in the model, using as predictors the seven binary features as before. With the null hypothesis that all utterances are not questions, which could account for 95.3 percent of the responses, the model could account for 99.3 percent of the responses, correctly identifying 61 percent of questions (compared to 0 percent based on the null hypothesis). The classification in this model was thus clearly better than in the previous one (cmp. 61% of questions correctly categorized to 38.1% in the previous model). The model was significant with $\chi^2_{(7)} = 218.090$ and p< .01. Compared to the model summarized in 3.3 the importance of the individual features differed, in that the feature **uncertainty** and **you know** were no longer statistically significant. This is as expected, given that most of the utterances with *you know* were not classified as questions by the majority of the judges (but they had an impact in the model evaluated in table 3.3, where all opinions mattered, because of their frequent occurrence in the conversational sample). Of the remaining features, again inversion was the most relevant one, followed by turn-finality and the presence of a *wh*-word. The results for the individual features are summarized in table 3.4.

Discussion

To sum up the results, the level of agreement regarding which utterances were questions was quite poor among the native speakers who participated, and exhibited great variation. This result suggests that speakers, if consistent in their judgments, employed different definitions of the term 'question'. This possibility received further confirmation through a logistic regression analysis of the data, using seven binary features associated with questions as predictors. Individual models varied in that some judges appeared to give most weight to subject-finite verb inversion, while for others it was the presence of *'you know'* in the utterance (a factor which, on the other hand, was not statistically significant in the model

Table 3.4: Importance of individual features in a model for merged responses with majority question categorization.

	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
uncertainty	7.642	.28.703	.071	1	.790	2083.452
you know	-.553	1.194	.215	1	.643	.575
wh-word	-3.482	.632	30.329	1	<.01	.031
yes/no-answer	-2.019	.630	10.286	1	.01	.133
inversion	-5.233	1.000	27.369	1	<.01	.005
question test	-2.238	.729	9.420	1	.02	.107
turn final	-3.615	.869	17.307	1	<.01	.027

of some judges). In a general model with merged responses, where as questions were considered all utterances that were classified as such by at least one judge, the seven predictor features all appeared to play a role in question identification, the two most important being subject-finite verb inversion and the presence of *'you know'*. Since the responses exhibited a great variation, the features were also evaluated in a model with merged responses where as questions were considered only utterances so classified by the majority of judges. In this model, 99.3 of the utterances were correctly classified (61 % of those considered questions); only five of the seven predictor features were statistically significant, with inversion being the most important one.

Crucially for the present work, the observations regarding subject variation in the use of the term 'question' have implications for intonation research. In particular, they indicate that in categorization tasks designed to investigate the interpretation of contours, it cannot be taken for granted that subjects employ the same definition of the term 'question'. From this, it can be concluded that speakers' idea of what the term 'question' signifies may not be sufficiently uniform to use the notion reliably in a perceptual experiment testing the interpretation of various intonational contours (as discussed in the literature review section of this chapter).

Another important point for the current study are the theoretical implications of the experimental results. It has been observed in the past that the boundary between questions and statements is not very clear. Therefore, some authors suggested to view the difference as a continuum, rather than a categorical distinction (viz. the discussion in [Haan, 2002]). This cannot be an explanation for the results found here, though, because the ranking of the predictor features differed for the individual subjects. In fact, a feature (e.g., the presence of the *you know* phrase) could be the most significant question predictor in some models and not have any significance in others. Presumably, if the problem with categorizing questions was that the difference between questions and statements is a continuum, the experimental participants would be expected to differ only in how strict

they are in their judgments (some of them employing a very narrow definition, others a very broad one), but to preserve the same ranking.

One possible explanation that appears to be in line with the results reported above is that the semantic and the pragmatic interpretations of the term 'question' were confounded. Under the semantic interpretation, as questions are considered only interrogatives (i.e., utterances with subject – finite verb inversion and possibly the presence of a *wh*-word). In fact, this appeared to be the core interpretation in that the predictor features **inversion** and **wh-word**, together with the statistically dependent turn-finality, were the most significant ones in a model with merged responses based on majority classification. Another interpretation concerns utterances which appear to be *response seeking* in a broad sense, i.e., ranging from acknowledgment that the addressee has heard and understood an utterance to the addressee performing a non-verbal action in the sense of [Clark, 1996]. Note that for "true" interrogatives, both the semantic and the pragmatic component are present (they have the semantics of questions and the discourse function to signal response-seeking). Rhetorical questions, however, lack the pragmatic component and this may have been the reason why some judges classified them as questions and others did not. The purely response-seeking-based interpretation would be the reason why some judges classified all occurrences of the phrase *you know* as questions, since the phrase usually serves to elicit a low-level acknowledgment (at least signaling that the speaker has the listener's attention, e.g., in the form of a small nod or eye gaze in the speaker's direction). Also, it accounts for the otherwise unexpected categorization of imperatives as questions, as in (9), where the imperative is response-seeking in that it asks for a non-verbal action from the listener. Other points of disagreement noted above, such as expressed uncertainty or eliciting a direct witness account of reported events also fall into the category of response-seeking utterances.

In order to employ a more transparent terminology, from now on the term 'response-seeking' will be used for the pragmatic function of interrogatives, as well as other utterances which ask for the listener's response, be it a low-level acknowledgment (e.g., "yes, I heard you"), a higher level acknowledgment (e.g., "yes, I understood you"), an evaluative response (e.g., "yes, I believe that it is true") or a non-verbal action response (e.g., looking where the speaker is pointing (9)). Clearly, there is no one-to-one relation between the semantic denotation and the pragmatic function, in that not all interrogatives are response-seeking (e.g., rhetorical questions). In the same way, not all response-seeking utterances denote questions. In fact, I will suggest in chapter 5 that only interrogatives denote questions and that the response-seeking effect of some declaratives is of a purely pragmatic nature.[13]

[13]Is there at all a direct relation between the question denotation and response-seeking? Or is the primary pragmatic function of the use of interrogatives the raising of a discourse topic, and the response-seeking a derived pragmatic effect?

3.4 What is a 'question contour'?

In section 3.2 of this chapter, I have discussed perceptual and corpus studies of question intonation and noted that there is a discrepancy in their results. In perceptual studies, it was found that a rising contour is perceived as questioning. On the other hand, in corpus studies, it was found that questions often occur without rises. I argued that one of the problems with the findings lies in the definition of 'question', in that the understanding of the notion is, in general, not uniform. Based on the results of the categorization task reported in section 3.3, it was suggested to reserve the term 'question' for semantic objects denoted only by interrogatives, and to use the term 'response-seeking' for utterances which can have the same effect as (most) interrogatives in the context. In order to make the categorization more precise, I will further distinguish between utterances seeking an evaluative response (like a *yes/no*-answer) and those seeking another type of response (acknowledgment, etc.). The canonical type of reply expected to interrogatives that are response-seeking will be assumed to be evaluative. What has so far been called 'question' intonation in the literature will thus from now on be referred as 'evaluative response-seeking intonation'.

The first issue to be raised concerns the import of intonation for recognition of evaluative response-seeking. Does intonation play a role at all? According to [Geluykens, 1988] for British English, intonation cues are virtually irrelevant in this respect. It could thus very well be the case that in the absence of morpho-syntactic cues (subject-finite verb inversion, presence of a *wh*-word), evaluative response-seeking utterances are recognized by their context and lexico-pragmatic features (subject in the *second person singular*, hetero-cognitive predicate, etc.). If this is so, then there should presumably be no difference in the use of evaluative response-seeking utterances with the declarative form in written and spoken conversations; on the other hand, if intonation plays a role, one would expect the number of these types of utterances in written conversations to be much lower. In fact, this is what [Beun, 1990] reports for Dutch (in his corpus of written conversations, what he calls 'declarative questions' did not appear at all). Below, I describe a comparison of spoken and written conversations which were examined from this perspective (I will use the term 'utterance' to refer also to sentences used in written conversations).

3.4.1 Written vs. spoken conversations

The hypothesis tested in the corpus sample study was formulated as below, where **ERS** stands for 'evaluative response-seeking'. If disproved, the result would suggest that acoustic properties (and thus, presumably, intonation) play a role in expressing the evaluative response-seeking function.

Unmarked ERS utterances can be used in written conversations.

As unmarked were taken to be utterances that were non-interrogative and lacked a *wh*-word, since these are two properties that help to identify the evaluative response-seeking function. Other ERS indicators included in the study were the presence of a question mark (in the written sample), an utterance-initial hesitation marker like *so/and/but/hmm*[14], and the presence of a hetero-cognitive predicate. Making use of the significant predictor features for a majority opinion from the previous experiment (viz. table 3.4), it was also assumed that a *wh*-less declarative utterance can only genuinely be intended as evaluative response-seeking if it satisfies the following properties: It is turn-final, i.e., if after the speaker has uttered it, she pauses and waits for a response from the addressee. Second, it was also recognized as evaluative response-seeking by the addressee, in the sense that a reply was offered that contextually entailed a *yes, no* or *I don't know* answer.[15] Finally, since replies to evaluative response-seeking utterances can be homonymous with replies meant as acknowledgments, the question test used as a predicting feature in section 3.3 was employed: if a turn-final declarative followed by an answer-like response could be replaced with a corresponding interrogative (created by simple subject-finite verb inversion) without giving rise to infelicitous discourse, the utterance was classified as evaluative response-seeking.

As a material for the study, American English chat transcripts (in conversations where visual information was unavailable) were compared with transcripts of spoken conversations from the Santa Barbara Corpus. The assembled corpora samples were of the same size, expressed in the number of turns, with as many different speakers included as possible, given the size of the corpus. Evaluative response-seeking utterances were classified on the basis of the procedure described above. It was observed that in a conversation transcript with more than two participants, the response to an utterance did not necessarily immediately follow the utterances itself since a third speaker could interfere.

The results, summarized in the table below, show that in the written conversations, there are (utterances categorized as) evaluative response-seeking which appeared without any of the assumed indicators. In particular, there were 19 utterances classified as evaluative response-seeking declaratives in the written sample; 12 of them ended with a question mark and 14 of them contained what was considered an ERS indicator (other than the question mark), but 5 of them did not appear to be overtly ERS-marked.

The hypothesis stated above was not disproved by the results of the study. At the same time, though, ERS utterances do not appear to be used with the

[14]These hesitation markers were noted by [Beun, 1990] to co-occur frequently with 'declarative questions' in Dutch.

[15]Some evaluative response-seeking utterances may not get a response, but in those cases, it is difficult to decide whether it was because they were not recognized or because the addressee is not being cooperative. There may also be utterances which were not meant as evaluative response-seeking, yet were turn-final and treated that way by the addressee. These utterances cannot be identified without having access to the intentions of the speaker/writer.

Table 3.5: Use of declarative questions in spoken vs. written conversations.

	Written	Spoken
Turns	1521	1521
Speakers	71	50
Polar interrogatives	126	66
ERS declaratives	19	41
With a question mark	12	–
With other ERS indicators	14	11
Without ERS indicator	5	30

same frequency in written and spoken conversations. There was a substantial difference between the number of declarative ERS utterances found in the written and in the spoken sample (5 and 30, respectively). This difference could be due to style: For instance, one could speculate that new topics and sub-topics are more frequently raised in writing (note the substantially higher number of polar interrogatives in the written sample compared to the spoken sample). If declarative ERS utterances normally do not fulfill this function, e.g., because they are mostly used for clarification, it would explain why they were under-represented in the written sample. On the other hand, the reason why unmarked ERS declaratives are not used so frequently in written conversations may be indicative of the role of prosody. The five cases categorized as unmarked ERS declaratives could be recognizable as such by other ERS predictors, not considered in the study.

In order to further evaluate the impact of intonation on recognition of evaluative response-seeking utterances, an experiment with three subtasks was designed as described in the following section.[16]

3.4.2 The role of intonation

Method

Materials

The experiment consisted of three tasks performed by different groups of subjects: a non-acoustic recognition task where transcriptions of utterances were provided, an acoustic recognition task with only speech stimuli and a combined task with both transcriptions and speech stimuli. The utterances used in the experiment were selected from the Santa Barbara Corpus of Spoken American English I and II and were of mostly mono-clausal form with no ellipsis, with clearly indicative

[16]The results for the first two tasks (transcript-only and audio-only) described below were previously presented in [Šafářová and Swerts, 2004].

syntax and no subject – finite verb inversion or *wh*-words. Depending on the context in which they occurred, they were labeled as either one of the following:

(a) evaluative response-seeking declarative
(b) acknowledgment-seeking declarative
(c) proper declarative

The complete list of the utterances with their immediate context is given in the appendix A to this thesis.

Evaluative response-seeking declaratives were those *wh*-less non-interrogative utterances that were turn-final, followed by a reply that contextually entailed a *yes, no* or *I don't know* answer and satisfied the **question test** (i.e., in the context would be felicitous as interrogatives). As acknowledgment-seeking declaratives were categorized utterances followed by a backchannel by the addressee but not turn-completing. The category of proper declaratives was formed by non-turn-completing utterances immediately followed by another utterance by the same speaker and not responded to by the addressee in the following turn. In order to exclude possible prosodic effects, the categorization was made on transcripts of the corpus, disregarding the punctuation marks used by the corpus transcribers. However, for some ambiguous cases, also the prosodic properties of the *responses* to the selected utterances were taken into consideration. In particular, there is an overlap in the lexical expressions used for backchannels (which acknowledge the speaker's contribution without taking the floor and are indicative of acknowledgment-seeking declaratives) and confirmations used to assert an opinion and indicative of evaluative response-seeking declaratives; this overlap can be resolved by prosody (viz. [Shriberg et al., 1998]).

The assumption was that of the 93 sentences in total (31 of each type by 15 female and 16 male speakers, with all three types per speaker), those of type (a) were most likely to have been intended by the speakers to be "questioning".

Table 3.6: Description of three experimental tasks.

Task	Description
Acoustic	Only acoustic stimuli available.
Non-acoustic	Only transcription of utterances available.
Combined	Both transcriptions and acoustic stimuli available.

Participants
Fifty-one subjects, all native speakers of American English, participated as judges in the experiment with three different tasks, i.e., seventeen subjects per task. They were not paid for their participation but had a chance of winning an Amazon gift certificate.

Procedure
The stimuli were presented to the subjects interactively on the internet, using the `wwstim` cgi-scripts [Veenker, 2006]. Each time the experiment was accessed, `wwstim` randomized the presentation of the stimuli; this way, possible effects of learning were lessened.

The subjects were instructed to categorize each stimulus as either one of three categories, described in terms of expected responses to the utterance as follows:

1. **no response:** the speaker just continues talking without expecting to receive or receiving a reply from the addressee
2. **brief acknowledgment:** the addressee shows that (s)he has heard and understood the speaker and the speaker then continues talking
3. **evaluative response:** the speaker stops talking and expects that the addressee will confirm or negate what has just been said

On the entry page to the experiment, the subjects were also given examples of the three categories:

1. SPEAKER: *the cheapest flights to Liverpool are with EasyJet*
   Continuation:
   SPEAKER: *the only problem is that you have to buy the ticket long before*
2. SPEAKER: *this way you can turn static HTML into dynamic*
   Continuation:
   ADDRESSEE: *okay/mhm/right*
3. SPEAKER: *so Mabel is not coming tonight*
   Continuation:
   ADDRESSEE: *no, she has other plans*

In the two tasks in which the acoustic stimuli were used (i.e., in the acoustic and in the combined task), judges could listen to the sound file as many times as they needed. In addition, they were asked to indicate in a 'remarks' window if they could not hear the utterance properly.

Results and discussion

In all three tasks, judges tended to be able to distinguish (what was understood to be) evaluative response-seeking declaratives from the other two utterance types, viz. table 3.7, 3.8 and 3.9 (taking into account only utterances that got a statistically significant classification, based on χ^2 tests, $p < .05$). The fact that in general, only about a half of the 33 evaluative response-seeking utterances was

Table 3.7: Significant classification of declarative sentences in the transcription task (*NR = no response, BA = brief acknowledgment, ER = evaluative response*).

Judged as: / Decl.Type	NR	BA	ER
NR	5	4	1
BA	4	3	2
ER	1	3	**16**

significantly recognized can be ascribed to the absence of context and the possibility that not all the utterances selected for this category from the corpus by the method described above were, in fact, intended as such. The results for American English thus correspond to Beun's and Geluykens' conclusion for Dutch and British English, respectively, in that other than intonational features appear to play an important role in evaluative response-seeking (or, question recognition, for them): the results for the non-accoustic task were no worse than for the other two tasks.

Table 3.8: Significant classification of declarative sentences in the acoustic task (*NR = no response, BA = brief acknowledgment, ER = evaluative response*).

Judged as: / Decl.Type	NR	BA	ER
NR	12	1	2
BA	10	2	1
ER	6	0	**14**

Interestingly, the sets of utterances categorized as evaluative response-seeking were not entirely identical in the three tasks. In the set of 16 utterances correctly classified into this category in the transcription task, 9 were not classified as such in the acoustic task. Among these nine utterances, however, there were only two that were classified differently in a statistically significant way: the utterances *that's the last thing you wanted to hear* and *you x-rayed it with the cast on* were classified as evaluative response-seeking in the transcription task and as proper declaratives in the acoustic task.

Regarding the role of prosody in recognition of evaluative response-seeking utterances, a likely hypothesis is that though its presence is not necessary, it contributes 'added value' in the absence of other cues.[17] If this is the case, all ut-

[17]Crucially, it *only* has added value: as suggested by [Krahmer and Swerts, 2005] for intonation, it cannot override the meaning of lexical items.

Table 3.9: Significant classification of declarative sentences in the combined task (*NR = no response, BA = brief acknowledgment, ER = evaluative response*).

Judged as: / Decl.Type	NR	BA	ER
NR	13	5	1
BA	10	3	1
ER	2	2	**15**

terances recognized in this category in the transcription task should be identified also when subjects had access to their sound, in addition to utterances that are characterized as evaluative response-seeking solely by their prosody. Therefore, in fact already in the acoustic task, one could have expected a better recognition level than in the transcription task, but it was not clear if subjects understood the tested utterances correctly. For this reason, the results in the first two tasks were compared to the results of the task with access to both the acoustic properties of utterances, as well as to their transcriptions. The prediction was that if prosody only has 'added value', in the combined task, a higher number of utterances should be significantly categorized as evaluative response-seeking. This prediction was not confirmed by the results of the experiment (viz. table 3.9). This result suggests that whatever the interaction of prosodic and lexico-pragmatic properties of an utterance, the added-value proposal is not the correct explanation.

Another comparison concerned the set of utterances classified as evaluative response-seeking in the combined task with the sets for the previous two groups. A great overlap was found between the ER-set in the combined task and the ER-set in the acoustic task (all the utterances classified into this category in the acoustic task were also classified this way in the combined task). This result suggests that subjects in the acoustic experiment heard and understood the lexical content of the cues quite well. On the other hand, there were 9 evaluative response-seeking utterances that were classified as such in the transcription task but not recognized in the combined task. If prosody only had a weak added value, one would expect these utterances to be classified into the ER-category in the combined task as well. It seems that they were lacking some crucial prosodic property (or alternatively, they had a prosodic property evaluative response-seeking utterances do not have).

So far, I have only discussed how 'well' subjects were able to classify utterances that were considered to be evaluative response-seeking. Given that it was not certain that the utterances we extracted from the corpus with a correct procedure, the results were analyzed also from a purely perceptual perspective.

The original ternary categorization was reduced into a binary one (ER *versus* not-ER) and eight binary features (three lexical-pragmatic and five intonational) were identified as possibly having played a role in the subjects' decision process

(viz. table 3.10; T there stands for {L, H}).

Table 3.10: Summary of intonational features possibly used as markers of evaluative response-seeking.

Name of feature	Description (Utterance contained ...)
you	a second person personal pronoun in any syntactic position
I	a first person pronoun in any syntactic position
particle	utterance-initial *and/but/so/oh*
Steedman	utterance-final high boundary tone
GunlogsonA	a nuclear phrase H*H-H%, L*H-H%, L*H-L% or L*L-H%
GunlogsonB	non-falling from nuclear accent and T% higher than T*
Bartels	a nuclear phrase L*H-%H, L*H-L%, H*H-H% or H*H-L%
TQC	a nuclear phrase with the "typical question contour" L*H-H%
C-rise	in nuclear phrase, low phrase tone and high boundary, L-H%

The *I*- and *you*-feature were taken to correspond to Le Nestour's distinction between auto-cognitive and hetero-cognitive. One could argue that not all utterances containing the pronoun *you* are necessarily hetero-cognitive, but no such examples were found in the data; in fact, most utterances containing the pronoun could clearly be classified as hetero-cognitive (e.g., *you don't know, you only have twelve kids, that's the last thing you wanted to hear*) and only a few were ambiguous (e.g., *you have no idea*). Similarly the utterances with the first person singular pronoun were mostly auto-cognitive (e.g., *I'm not smart, I cannot get over this, I could read you some*) with a few ambiguous cases (e.g., *I have no idea, I packed two palates*). The ambiguous cases were classified depending on the pronoun they contained. Note that the *I*-feature was expected to have the opposing trend compared to the other features.

The nuclear phrases of all the utterances used in the experiment were labeled with MAE-ToBI by three paid professional annotators from the Ohio State University and the New York University.

In order to achieve a better inter-annotator agreement, the narrow ToBI alphabet used by the annotators was translated into a broad ToBI, based on the findings of [Herman and McGory, 2002]. For one, these authors report a conceptual similarity of bitonal and monotonal pitch accents with the same 'head' (i.e., L+H* to H*, L*+H to L*, etc.) and the downstepped H! to H (see also [Pitrelli et al., 1994] and [Syrdal and McGory, 2000]). All bitonal accents were, therefore, translated into monotonal ones and all downstepped high tones to simple high tones. Another potential similarity and thus a possible source of disagreement, namely the presence of different kinds of boundaries (e.g., major versus minor boundary, as in L versus LL, H versus HH, but also no boundary versus minor boundary) was not a problem. Given that the point of interest were

nuclear phrases which are utterance-final, it was clear that both a minor and a major phrase boundary had to be present. For the resulting annotation, majority opinion was taken to be decisive. In some cases, the annotators did not agree on the exact location of the pitch accent in the nuclear phrase, but also in those cases it was possible to follow the majority opinion. Note that because of the use of the broad ToBI alphabet, the acoustic features in table 3.10 could stand for larger sets of contours than just those listed above. For example, the TQC (typical question contour) feature would not just refer to L*H-H%, but possibly also to L*+H H-H%, L*+!H H-H%, L* !H- H%, L*+H !H- H% and L*+!H !H-H%. In practice, it was not possible to determine what narrow ToBI contours appeared in the annotated data due to low inter-annotator agreement, especially with respect to bitonal pitch accents.

After the ToBI annotations, the contours were examined with the help of Praat and categorized with respect to the GunlogsonB feature; the location of the pitch accent was the same as in the ToBI annotation. Note that the 'GunlogsonB' feature differs from the other intonational features in that it is non-phonological; the reason why it was considered in the evaluation of the results was that it served as the initial motivation for Gunlogson's definition, but Gunlogson's ToBI set does not quite correspond to it (see also chapter 4 for examples and discussion). Also, Gunlogson only includes monotonal pitch accents in her characterization and does not discuss downstep, so it is unclear whether she would consider contours such as L*+H L H% or H* !H H% to be rising, as they are in the employed broad ToBI notation.

The results of the non-acoustic task were analyzed with respect to the lexical-pragmatic features, the acoustic task with respect to the intonational features and the combined task from the perspective of both types of features. Table 3.11 gives the average proportion of utterances classified as evaluative response-seeking as a function of the presence or absence of the three binary lexical-pragmatic features, and the corresponding Mann-Whitney U statistics to see whether the difference in average proportion is significant.

As the table shows, from the hypothesized lexical cues only the second person pronoun significantly distinguishes the ER category from the non-ER category. The effects of the first person singular pronoun and of the particle turn out to be non-significant. Table 3.12 reveals that the different assumptions regarding evaluative response-seeking intonation all significantly separate ER from non-ER utterances, but with a different degree of success. While the TQC feature appears to be the best predictor, due to sparsity of data, it is not possible to draw conclusions about its meaning. Of the remaining three features, Gunlogson's characterization gives the best results, though unfortunately, there was no instance of the contour L* H- L% in the data. Note also that the GunlogsonA and GunlogsonB features are better predictors than the Steedman feature, suggesting that the high boundary tone by itself is not unambiguously signaling evaluative response-seeking. The contour H* L- H% shows the opposite tendency, but the

Table 3.11: Import of lexical features to recognition of evaluative response-seeking utterances in the non-acoustic task.

Feature	Level	Av. Prop	Mann-Whitney U
You	Present (n=31)	.57	
	Absent (n=62)	.25	
			U=318, p< 0.01
I	Present (n=23)	.29	
	Absent (n=70)	.37	
			U=700, p=.348
Particle	Present (n=13)	.36	
	Absent (n=80)	.33	
			U=458, p=.490

data is too sparse to be entirely conclusive (there were only three instances of it in the set). The GunlogsonB feature by itself is a rather good predictor but there were fewer instances of it in the data than of Gunlogson's ToBI description (GunlogsonA feature).

As before, based solely on the results of the two simple tasks, it is impossible to determine the relationship between lexical-pragmatic information and intonational properties of utterances, so all the features were also analyzed with respect to the combined task. Again, if it were the case that intonation only plays a supporting role, we could expect it to be relevant in this task, but not as relevant as the lexical-pragmatic features (at least the *you*-feature which was found to be a predictor in the transcription task). The results of the complex task in 3.13 show, however, that none of the lexical-pragmatic features were, in fact, significant for categorization in the combined task. This result can be compared to the results reported in table 3.9 which shows that recognition of evaluative response-seeking utterances was not significantly better in the combined task than in the simple tasks. The conclusion one can draw is that the two types of cues do not support each other and also that intonation is not *weaker* than the selected lexico-pragmatic features (especially the *you*-feature).

As noted above, according to some researchers, the final rise associated with evaluative response-seeking utterances (or, in their terminology, questions) is the same rise found to indicate continuations. In order to test this hypothesis, the categorization of proper declaratives as opposed to the other two groups was analyzed; the goal was to find out whether the contours supporting recognition of evaluative response-seeking utterances were also significant for continuation recognition in the two tasks in which subjects had access to prosodic information. As a separate feature, the combination of a low phrase tone with a high boundary tone was considered which [Pierrehumbert and Hirschberg, 1990] take to be the

Table 3.12: Import of intonational features to recognition of evaluative response-seeking utterances in the acoustic task.

Feature	Level	Av.Prop.	Mann-Whitney U
Steedman	Present (n=21)	.54	
	Absent (n=72)	.22	
			U=341, p< 0.01
GunlogsonA	Present (n=18)	.62	
	Absent (n=75)	.21	
			U=208.5, p< 0.01
GunlogsonB	Present (n=8)	.75	
	Absent (n=85)	.44	
			U=117.5, p<0.01
Bartels	Present (n=35)	.46	
	Absent (n=58)	.18	
			U=511, p< 0.01
TQC	Present (n=4)	.81	
	Absent (n=89)	.27	
			U=19, p< 0.01

continuation rise (feature 'C-rise').

The results, summarized in table 3.14 and 3.15 show that, in general, this was not the case: the results of the speech task were mostly non-significant and the results of the combined task showed an opposite trend. Neither in the results of the speech task, nor in the results of the combined task was the C-rise contour significantly associated with continuations (note, however, the sparsity of the data). Finally, given its total absence in the set of selected utterances, it was impossible to test the contour L* H- L% which was in the set of contours proposed by Gunlogson and Bartels, and which could be an instance of the high plateau identified by [Wichmann and Caspers, 2001] for continuation rises. It was concluded that at least in this data set, there was nothing to suggest that the evaluative response-seeking contour(s) and the continuation contour(s) are related.

As already noted above, there exists reported evidence that rising intonation on declaratives in American English is used also in contexts where it is clear that the speaker is an expert on the issue. These rising declaratives cannot be interpreted as evaluative response-seeking in any sense, since they are used to assert some new information ([McLemore, 1991b], [McLemore, 1991a], [Hirschberg and Ward, 1995], [Seaton, 2001]). [Fletcher et al., 2002] examined a corpus of Australian map task dialogues and found that with respect to final rises, information requests and tags (questions) were almost always realized with

Table 3.13: Import of intonational and lexical features to recognition of evaluative response-seeking utterances in the combined task.

Feature	Level	Av. Prop.	Mann-Whitney U
Steedman	Present (n=21)	.59	
	Absent (n=72)	.20	
			U=299, p< 0.01
GunlogsonA	Present (n=18)	.69	
	Absent (n=75)	.19	
			U=161, p< 0.01
GunlogsonB	Present (n=8)	.78	
	Absent (n=85)	.44	
			U=92, p=0.01
Bartels	Present (n=35)	.49	
	Absent (n=58)	.16	
			U=527, p< 0.01
TQC	Present (n=4)	.78	
	Absent (n=89)	.26	
			U=39, p<0.01
You	Present (n=31)	.40	
	Absent (n=62)	.23	
			U=669, p=0.16
I	Present (n=23)	.27	
	Absent (n=70)	.29	
			U=744, p=.586
Particle	Present (n=13)	.38	
	Absent (n=80)	.27	
			U=455, p=.463

a (high-onset) high rise (H*H-H%, as opposed to L*H-H%), whereas statements and action directives rarely appeared with this type of contour. In American English, however, speakers do not seem to make the distinction found in Australian English. Although a comparative corpus study of the sort done by Fletcher and her colleagues is unavailable, the results of the experiment suggest that American English speakers tend to associate both high- and low-onset rises with evaluative response-seeking (both of these contours belong to the Gunlogson's ToBI set). Two examples are given below of utterances that were both annotated as evaluative response-seeking in the corpus and also recognized by the significant majority of the judges in the acoustic task; (14-b) is low-rising, whereas (15-c) is high-rising.

(14) a. Jennifer: *Look at you being smart.*

Table 3.14: Import of intonational features to continuation recognition in the acoustic task.

Feature	Level	Av.Prop.	Mann-Whitney U
Steedman	Present (n=21)	.46	
	Absent (n=72)	.40	
			U=662.5, p = 0.389
GunlogsonA	Present (n=18)	.53	
	Absent (n=75)	.39	
			U=454, p = 0.031
Bartels	Present (n=35)	.42	
	Absent (n=58)	.41	
			U=996.5, p = 0.883
TQC	Present (n=4)	.56	
	Absent (n=89)	.41	
			U=115, p = 0.232
C-rise	Present (n=4)	.34	
	Absent (n=89)	.42	
			U=145.5, p = 0.537

b. Dan: *I'm not smart?*
c. Jennifer: *You're stupid.*
d. Dan: *Don't call me stupid.*
e. Jennifer: *Mm. Alright.*

(15) a. Dan: *Let's check that one out. Wait, play... novice.*
b. (Dan:) *I've never played hearts before in my life -*
c. Jennifer: *You've never played hearts?*
d. Dan: *No, I don't know how to play it.*
e. Jennifer: *Oh. Okay. I'll teach you.*

Finally, with respect to the association of the GunlogsonB feature and the evaluative response-seeking function, it appears that the presence of the feature is neither sufficient, nor necessary. Examples were found in the corpus sample of utterances that were categorized as proper declaratives (i.e., not response-seeking in any way), yet were rendered with a high-rising contour, which belongs to the GunlogsonB set, viz.(16-b) and (17-d). On the perceptual side, there were utterances significantly classified in the "no response" category in the acoustic task which had the GunlogsonB feature (in (18) a high-rise H*H-H%).

(16) a. Melissa: *Just two more. Actually, that.*
b. Jan: *okay, I'm gonna check on you in ten minutes*
c. (Jan:) *if you haven't gotten one page done in ten minutes you'll go*

Table 3.15: Import of intonational features to continuation recognition in the combined task.

Feature	Level	Av.Prop.	Mann-Whitney U
Steedman	Present (n=21)	.19	
	Absent (n=72)	.45	
			U=322, p< 0.01
GunlogsonA	Present (n=18)	.14	
	Absent (n=75)	.45	
			U=208.5, p< 0.01
Bartels	Present (n=35)	.27	
	Absent (n=58)	.46	
			U=587, p < 0.01
TQC	Present (n=4)	.05	
	Absent (n=89)	.41	
			U=36, p < 0.01
C-rise	Present (n=4)	.27	
	Absent (n=89)	.40	
			U=120, p = 0.271

d. Melissa: *One side of a page? It takes me a long time,*
e. (Melissa:) *because I've got to go over the sentences*

(17) a. Montoya: *to mobilize large numbers of people,*
b. (Montoya:) *into some kind of a effort or movement.*
c. (Montoya:) *. . . Alright.*
d. (Montoya:) *So he's correct.*
e. (Montoya:) *It depends on the time, depends on the circumstances. . .*

(18) *we could pass that back to the customer*

To sum up, in this section, I have reported the results of three categorization tasks. The main purpose of the experiment was to find out what (if any) role is played by intonation for signaling that an utterance is evaluative response-seeking. It was found that among the contours proposed in the literature as possibly relevant, the contours characterized by Gunlogson as non-falling from the nuclear accent and with the boundary tone ending higher than the nuclear pitch accent, and specified by her in a broad ToBI notation as H*H-H%, L*H-H% , L*H-L% and L*L-H%, could be used as statistically significant predictors. Furthermore, the responses of the judges in the categorization tasks suggested that these contours are not interpreted as signals of continuation. Finally, none of the lexical-pragmatic features considered (presence of first or second person pronoun or presence of a specific particle) was significant for recognition of evaluative response-seeking utterances in a task where subjects had access to acoustic

information. At least in this respect, intonation thus appears to be interpreted as the more relevant marker.

3.5 Summary

The central theme examined in this chapter was the hypothesis that there exists a typical question intonation in American English, i.e., a contour or a set of contours which carry the meaning "question". Based on the review of existing literature I argued that there are reasons to re-examine the existing empirical results. Crucially, the term 'question' can be used with different interpretations by native speakers, as shown by the results of an experiment where participants were asked to select questions in a conversation transcript. On the basis of the experimental findings, it was argued that in the use of the term 'question', its semantic and pragmatic import are conflated by experimental participants . In order to distinguish between the two linguistic levels, it was suggested to reserve the term 'question' for the denotation of interrogatives and to use the term 'response-seeking' for utterances which receive a response by the addressee. Among these, utterances which receive a reply comparable to an answer to interrogatives (here, specified as contextually entailing *'yes', 'no'* or *'I don't know'*) were distinguished under the label 'evaluative response-seeking utterances'.

An experiment was designed to test for contours which speakers perceive as response-seeking on declarative utterances. The utterances were extracted from a corpus of free conversational speech and categorized into three equally large groups referred to as 'proper declaratives', 'acknowledgment-seeking declaratives' and 'evaluative response-seeking declaratives', depending on their position and follow-up utterance. For the purposes of the categorization task, the term 'evaluative response-seeking utterance' was interpreted in the experimental instructions to the participating judges as "the speaker stops talking and expects that the addressee will confirm or negate what has just been said". In order to evaluate the possible association of their responses to intonational patterns, the experimental stimuli were annotated by professional ToBI annotators. Their labeling was translated into a broad ToBI notation, in order to achieve a better inter-rater agreement and also to evaluate some existing proposals regarding the 'question contour' (i.e., a contour signaling the evaluative response-seeking function). The best predictors in this sense turned out to be the tunes L*H-H%, H*H-H% and L*L-H%. However, the presence of these contours was neither sufficient nor necessary for the categorization of an utterance as evaluative response-seeking.

The results were also examined for a possible association of some intonational patterns (in particular the three contours L*H-H%, H*H-H% and L*L-H%, but also other types of rises) with 'continuation'. Continuation was here interpreted as an utterance that is not responded to, "the speaker just continues talking without expecting to receive or receiving a reply from the addressee". Under

this interpretation, there was no statistically significant link between the tested contours and continuation, suggesting that theoretical approaches which conflate the response-seeking association of rising contours (in the sense considered here) with continuation (e.g., interpreting both as "discourse incompleteness") are not appropriate for American English.

An interesting result also concerns the sometimes assumed "added value" of intonation, i.e., the idea that intonation does not have an intrinsic meaning but if combined with the right utterance features, it would help the listener with its interpretation. If this were the case, one would expect that in the combined task, a higher number of utterances should be significantly categorized as evaluative response-seeking. This prediction was not confirmed by the results of the experiment.

Finally, with respect to the identification of evaluative response-seeking utterances, intonation was not weaker than other features of the utterance. The features considered here were the presence of a hetero-cognitive and auto-cognitive predicate and the presence of sentence-initial particle like *so, but* or *maybe*. In a task in which participants had no access to prosody, the presence of a hetero-cognitive predicate was the best predictor for the evaluative response-seeking interpretation. In tasks in which the acoustic recording of the utterance was available, however, none of the non-intonational features played a statistically significant role.

The empirical results summarized in this chapter have implications for a semantic model designed to capture the meaning of the three rising contours found to be the best predictor of the evaluative response-seeking interpretation. An important piece of evidence is that the rising contours appear to be neither necessary nor sufficient for an utterance to be perceived in this sense. Together with the fact that intonational meaning is not weaker than other utterance features that contribute to classification into the evaluative response-seeking category, and with the observations reported in other studies regarding the interpretation of rising contours (in particular, their attitudinal import, which is not directly linked to evaluative response-seeking status, such as uncertainty, lack of confidence, politeness, etc.), they lead me to the idea that the link between nuclear rises (L*H-H%, H*H-H% and L*L-H%) and evaluative response-seeking is indirect and due to a third variable. In particular, I will argue in chapter 5 of this thesis that the rises serve as expressions of epistemic uncertainty. Before the semantic analysis, in chapter 4, I will examine the meaning of nuclear rises (and falls) on interrogatives.

Chapter 4

Rising and falling interrogatives

4.1 Introduction

In this chapter, I focus on the interpretation of polar (*yes/no-*) interrogatives and their intonation. As already noted in chapter 3, it has been observed for American English that in spoken corpora, on average about a half of polar interrogatives are falling and a half of them are rising. So far, no corpus or experimental study has been done as to whether the types of contexts in which rising and falling polar interrogatives are found systematically differ, and if yes, in what way. This issue is obviously of interest to the research in intonational meaning in general, and that of question/rising intonation in particular: if rising and falling interrogatives *are*, in fact, used in two distinct kinds of contexts, we can attribute this effect to a difference in intonational meaning between rises and falls.

In the next section, I will first summarize claims that have been made with respect to the interpretation of polar interrogatives with particular intonational patterns in American English, including observations regarding tag questions. It is often assumed that falling polar interrogatives – unlike their rising counterparts – express speaker's bias. Following the proposal of [Nilsenová and van Rooy, 2002] and [van Rooy and Šafářová, 2003], presented briefly in section 4.3, I will make the distinction between two kinds of speaker's bias, referred to here as *informational bias* and *desired-state bias* and show how it relates to the claims that falling polar interrogatives are interpreted as *conducive* or *confirmation-seeking* questions and in some contexts as commands. Subsequently, I will present results of a corpus study of the use of polar interrogatives in conversational speech, followed by an experiment designed to test the association of rising and falling polar interrogatives with bias. I will consider three interpretations of the term 'rising polar interrogative': (1) a polar interrogative ending with a high boundary tone (H%), (2) a polar interrogative carrying the GunlogsonA feature (i.e., containing the nuclear contours H*H-H%, L*H-H%, L*L-H% and L*H-H%) and (3) a polar interrogative carrying the GunlogsonB feature (i.e., with a contour that

is non-falling from the last pitch accent in the nuclear phrase to its terminus and ends higher than the level of the last nuclear pitch accent). Based on the results of the experimental study, I will conclude that there is a strong link between one type of bias (the *desired-state bias*) and the GunlogsonA feature, and an even stronger link between this type of bias and the presence of an utterance-final high boundary tone.

4.2 Two types of interrogatives?

According to several authors, the interpretation of polar interrogatives in English differs depending on their intonational realization. For example, [Jones, 1966] notes that falling intonation (his Tune 1) on polar interrogatives makes them sound as a statement or invitation. Similarly, [Daneš, 1960], observes that falling polar interrogatives are intonationally marked: a question like *Will you come with us?* with falling pitch is "not a normal question at all but rather a kind of invitation or request". The idea that falling polar interrogatives resemble commands was further explored by [Lee, 1956], who, however, did not find support for this view when examining two corpora of distinct radio programs (one where questions were frequent and occurred with little intervening material, and another one where they were less frequent and separated by other utterances).

For reversed-polarity tag questions, a similar observation as for polar interrogatives has been made. [Ladd, 1981a] distinguishes two basic types of tag questions – what he refers to as 'true questions' and 'hedged assertions' – and describes the first type as rising and involving no separate nucleus, while the second type is falling and contains a separate nucleus. Other authors, like [Sadock, 1974], [Rando, 1980] or [Millar and Brown, 1979], also note the difference but for them it is simply due to the presence of an end rise/fall on the tag.[1]

To sum up, there seems to be a general agreement that there are two contours for polar interrogatives in English (whatever their actual shape), associated with different interpretations: one is more question-like (unbiased), the other more assertion-like (biased). The distinction between question-like polar interrogatives and assertion-like polar interrogatives in English seems to correspond to that between information- and confirmation-seeking questions, respectively, in French; these two types have also been matched to the difference between rising and falling pitch. Specifically, as noted by [di Cristo, 1998]:203-204, confirmation-seeking polar interrogatives are characterized by a final fall, preceded by a pitch peak associated with the penultimate, while information-seeking polar interrogatives are generally marked by a rising pitch associated with the last stressed syllable

[1]Note that another prediction is made by [Pierrehumbert and Hirschberg, 1990], in whose framework both true-question and hedged-assertion tag questions should be rising and would only differ in the pitch accent level: H*(H-H%) for true questions and L*(H-H%) for hedged assertions.

of the utterance.[2]

What exactly does it mean for a question to be "biased", "assertion-like", "confirmation-seeking", or, in the English linguistic tradition, "conducive"? As noted by [Ford et al., 2004], standard grammars of English like [Quirk et al., 1985] or [Biber et al., 1999] place "conducive" polar questions opposite to those with "neutral polarity":

> The conducive vs. neutral distinction proposes that some *yes-no* questions are analyzed as "anticipating", "expecting" or being "biased" toward a particular polarity. For example, "Did someone call you last night?" is interpreted as conducive, indicating that the "speaker is predisposed to the kind of answer he has wanted or expected" ([Quirk et al., 1985]:808); in this case a positive response is said to be expected, as encoded in the use of the assertive *someone* rather than the non-assertive *anyone*. Negative questions, by this account, are always interpreted as conducive, although whether they are biased toward positive or negative responses is complicated by the presence of assertive or non-assertive items (negative: *yet, either*; positive: *still, already*).
>
> [Ford et al., 2004]:238

[Ladusaw, 2004] (referring to [Huddleston and Pullum, 2002]) defines a biased question as

> one where the speaker is predisposed to accept one particular answer as the right one.

This type of bias can be referred to as informational or epistemic bias, in that it concerns a speaker's information state – her knowledge about the world. An example of an informationally biased question from [Romero and Han, 2004] is a negative polar interrogative with a preposed negation. For instance, in the context in (1), the question in (1-c) is unsuitable because it expresses speaker's bias towards the proposition 'Jane is coming' being true, i.e., the speaker believes 'Jane is coming' to be the case.

(1) Scenario: S hates both Pat and Jane. The prospect of an excursion without them pleases S. S does not have any previous belief about whether either of them is coming or not.
   a. A: *Pat is not coming.*
   b. S: *Great! Is Jane not coming (either)? That would be the best!!!*
   c. S': *# Great! Isn't Jane coming (either)? That would be the best!!!*

[2] [Fónagy and Bérard, 1973] actually observe an intonational difference with respect to expectations of an affirmative or a negative answer (i.e., two subtypes of the confirmative type).

Another example of an improperly used epistemically biased question is given in (2), also from [Romero and Han, 2004]. The interrogative in (2-c) is excluded because in the context, the speaker should not appear knowledgeable with respect to the issue she is raising.

(2) Scenario: S interviews A on TV about Rosa Montero.

a. A: *Mrs. Rosa Montero's writing career is closely related to the political episodes that Spain has lived through since 1936. There were times when she simultaneously worked on prose and poetry, but there were other times full of journalistic prose and completely devoid of poetry.*

b. S: *Please tell us more about those poetic gaps, and about what exactly caused them. For example, did she not write poetry in the 70s? And, if she didn't, why not?*

c. S': *# Didn't she write (some/any) poetry in the 70s? And, if she didn't, why not?*

Note that there is a discrepancy between Romero & Han's examples of epistemically biased questions (as in (1-c) and (2-c)) and the conducive questions of Daneš or Ford et al., e.g., *Will you come with us?* with respect to the polarity of the expected answer. While Romero & Han call "biased" those questions to which the speaker expects an answer with the *opposite* polarity (*Isn't Jane coming?* - expectation: 'Jane is coming.'), for other authors, it is the *same polarity* (*Will you come with us?* - expectation: 'You will come with us.' – *Did someone call you last night?* - expectation: 'Someone called you.').[3] This is not simply due to the difference between negative and polar interrogatives. Although Romero & Han do not assume that positive polar interrogatives could carry the strong epistemic implicature that interrogatives with preposed negation do (at least unless they contain the adverb *'really'* used in a particular sense), examples of this sort appear to exist. Consider the scenario in (3):

(3) a. A: *I read that they knew about the terrorist plans to destroy the WTC long before 9/11.*

b. B: *(I don't believe it.) Would the FBI just let it happen?*

The speaker B clearly believes the proposition with the opposite polarity to be true (*Would the FBI just let it happen?* - expectation: 'The FBI wouldn't just let it happen.'). In other words, both negative and positive polar interrogatives are able to generate an epistemic implicature with opposite polarity.[4]

[3] As a matter of fact, the negative interrogative without preposed negation in (1-b) from Romero & Han also expresses a kind of bias, which, however, does not appear to be for the proposition with reversed polarity. Here, the speaker wishes it to be the case that 'Jane is not coming' and she appears to be uninformed as to whether or not it is likely to be true; viz. below for a discussion.

[4] As (correctly) observed by Romero & Han, negative polars with preposed negation can

Here, I will argue that the varying polarity of the expected answer is due to the existence of two different kinds of bias, which I will refer to as *informational bias* and *desired-state bias*. For informational bias, the speaker expects the answer of opposite polarity, while for desired-state bias the speaker expects/wishes for the answer of the same polarity. The two kinds of bias will be described with decision-theoretic tools in the next section.[5] With the descriptive analysis of informational bias in place, I will proceed to examine its intonational reflections in a corpus of spontaneous conversational speech.

4.3 The context and meaning of different polar interrogative types

4.3.1 Previous Analyses of Biased Questions

Before describing formally the biased questions discussed above, let us first see what the meaning and use is of polar interrogatives in general. According to standard theories, with respect to their semantics there is no difference between positive polar interrogatives, negative polar interrogatives, and bi-polar alternative interrogatives (composed of two polar alternatives); the questions *Is Luke right? - Is Luke not right? - Is Luke right or not?* are assumed to have the same meaning. In particular, according to the Hamblin/Groenendijk & Stokhof ([Hamblin, 1973], [Groenendijk and Stokhof, 1984]) semantic theories of questions, the meaning of a question Q is a set of propositions that are "good" answers to the question. Thus the meaning of the question *Is Luke right?* is a set containing the proposition *Luke is right* and its complement, *Luke is not right*. The same holds for the negative polar question *Is Luke not right?*

(4) ‖Is Luke right?‖= ‖Is Luke not right?‖=
{λw[Luke is right in w], λw[Luke is not right in w]}

The meanings of bi-polar interrogatives like *Is Luke right or is Mark right?* can be seen as special cases of *wh*-questions. For example, in Hamblin's system (with von Stechow's extension regarding the meaning of the disjunctive connective) it is the union of two sets of propositions: those containing the proposition that *Luke is right* and those containing the proposition *Mark is right*.

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only receive one interpretation (that with the epistemic implicature of opposite polarity), while with embedded negation, they are ambiguous. Romero & Han account for the asymmetry by assuming that the preposed negation always triggers a VERUM focus. I return to the details of their proposal below in section 4.3 of this chapter.

[5] The material and the proposal summarized there is the result of joint work with Robert van Rooy from the University of Amsterdam. (An extended version of the section was previously published as [Nilsenová and van Rooy, 2002] and [van Rooy and Šafářová, 2003].)

(5) ‖Is Luke right or is Mark right?‖ =
{λw[Luke is right in w]} ∪ {λw[Mark is right in w]} =
{λw[Luke is right in w], λw[Mark is right in w]}

Consequently, the semantics of an alternative question composed of two polar alternatives, like *Is Luke right or is Luke not right?* is the same as the semantics of the polar question in (4).[6]

(6) ‖Is Luke right or is Luke not right?‖=
{λw[Luke is right in w], λw[Luke is not right in w]}

There is evidence, however, that positive, negative and bi-polar interrogatives are not always equally appropriate. One type of contexts where *positive* and *negative* polar interrogatives – although interchangeable – are not used with the same effect are contexts where knowledge that the *negative* proposition is true gets the speaker closer to her conversation goal. Consider, for instance, the case of a medical questionnaire regarding the health of a small child.[7] Presumably, because the goal of the procedure is to determine that a child is sick, the polarity of the interrogatives appears to be chosen in such a way so that affirmative answers support the affirmative conclusion. Thus *Is your child apathetic? Is your child not eating properly? Has (s)he not been sleeping for the last three days?*, rather than *Is your child not apathetic/lively? Is your child eating properly/well? Has (s)he been sleeping for the last three days?* Other questionnaire examples concern the ecological behavior of fellow citizens. For instance, internet questionnaires of which the goal is to classify the tested person as supportive of sustainable life style contain questions like *Do you turn off appliances when they are not in use? Do you not dump waste?* rather than *Do you not turn off appliances. . . ? Do you dump waste?*

Another set of examples showing the non-interchangeability of different types of polar interrogatives concerns polar and bi-polar interrogatives. When polar interrogatives are exchanged for the bi-polar variants and *vice versa* in context, the result is often infelicitous.[8] For example, while polar interrogatives are common as pleas or requests, bi-polar interrogative seem to convey a different message, compare (7-a) to (7-b) and (8-a) to (8-b).

(7) a. *Will you marry me?*
b. *Will you marry me or not?*
c. *Will you not marry me?*

(8) [train conductor to a passenger]

[6] [Groenendijk and Stokhof, 1984] – making use of a type-shift – basically predict the same.

[7] This example was found in actual hospital brochures.

[8] The examples discussed here are partly based on [Bolinger, 1978b]; the remaining examples were acceptable for the audience of the *Information Structure Conference 2002* in Stuttgart and *SALT XIII 2003* in Seattle.

a. *May I see your ticket?*
b. *May I see your ticket or not?*
c. *May I not see your ticket?*

Another example is that of drawing linguistic and situational inferences, as in (9) or (10): here, the polar interrogatives in (9-b) and (10-a) appear to be more appropriate than the bi-polar interrogatives in (9-c) and (10-b), respectively.

(9) a. A: *I just saw David.*
b. B: *Is David back from Toronto?*
c. B': *Is David back from Toronto or not?*
d. B":*Is David not back from Toronto?*

(10) [to someone who just came in with a dripping umbrella]
a. *Is it raining?*
b. *Is it raining or not?*
c. *Is it not raining?*

Note also that in all the examples above, the positive polar interrogatives cannot be replaced by negative polar interrogatives without a change in meaning, cmp.(7-a) to (7-c), (8-a) to (8-c), (9-b) to (9-d) and (10-a) to (10-c).

Similarly to pleas and requests, invitations (as in (11) and (12)) can be impolite if uttered as bi-polar interrogatives, cmp. (11-a) to (11-b) and (12-a) to (12-b).

(11) a. *Do you want something to drink?*
b. *Do you want something to drink or not?*

(12) a. *Cigarette?*
b. *Cigarette or not?*

Why can't positive polar interrogative, negative polar interrogatives, and bi-polar interrogatives always be considered variants of each other? One possible explanation is that, contrary to the standard assumption, as utterances they have a different semantics (i.e., do not have the same denotation). An existing proposal by [Roberts, 1996] is, in fact, based on this assumption. Roberts makes use of a semantics for polar questions based on an extended Hamblin's denotation for constituent questions ([Hamblin, 1973]). According to Hamblin's semantics for *wh*-questions ([Hamblin, 1973]), the meaning of a *wh*-question like *Who came?* is the following set of propositions: $\{\lambda w[\text{d came in } w] : d \in D\}$. When we extend this analysis to n-ary *wh*-questions, the following results (where $\vec{x}$ ($\vec{d}$) is an n-ary sequence of variables (individuals)):

$$\|?\vec{x}P\vec{x}\| \quad = \quad \{\lambda w[\vec{d} \in I_w(P)] : \vec{d} \in D^n\}$$

Polar questions result when $n = 0$, and the predicted denotation of $?q$ then is $\{q\}$. Under this interpretation, the positive and negative *Is Luke right?* and *Is*

Luke not right just denote the singleton set containing the proposition that Luke is right, $\{q\}$, and that he is not right, $\{\neg q\}$, respectively, while *Is Luke right or not?* denotes the set that contains both, $\{q, \neg q\}$. Roberts further assumes that the elements of a question-denotation are not given by the possible answers to the question (as in Groenendijk & Stokhof's semantics), but rather the propositions in the truth value of which the questioner is interested. Note, however, that at least assuming a two-valued semantics, if somebody is interested in learning if q is the case, she should be equally interested in learning if $\neg q$ is the case. The proposal thus does not make a distinction between the positive and negative proposition that can account for the difference in use between the three types of polar interrogatives. In fact, one could say that this is as expected, since the interrogative types mainly appear to be distinct in subtle conditions on their use (i.e., in their pragmatics), rather than in their intrinsic meaning.

A possible pragmatic way to account for the effect of different types of polar interrogatives in context could be formulated in terms of '*weak presupposition*'.[9] Weak presupposition is a kind of minimal evidence in the common ground; it is weaker than a real presupposition in that it can be triggered by embedded clauses (as in (13-a) for the particle *too* in (13-b)), or by a linguistic or a behavioral suggestion in the context.

(13) a. A: *John dreamt that Mary was in Spain.*
b. B: *Harry is in Spain, too.*

In fact, a context can contain a weak presupposition both for a positive proposition, as well as for its negation. The difference between the use of different types of interrogatives would then be captured by differences in the weak presuppositions as follows:[10]

Type of Interrogative	Context
positive polar interrogative $?q$	no weak presupposition or weak presupposition for q
negative polar interrogative $?\neg q$	weak presupposition for $\neg q$
bi-polar interrogative ($?q$ *or* $\neg q$)	weak presupposition for q and $\neg q$

One argument against the weak-presupposition analysis is based on the fact that a negative polar interrogative $?\neg q$ can be used in contexts which contain no

[9] Many thanks to Henk Zeevat for an extensive discussion concerning this idea.

[10] [Büring and Gunlogson, 2000] offer somewhat comparable intuitions in terms of their 'Evidence Conditions':

- Positive polar interrogative $?q$: there is no compelling evidence against q
- Negative polar interrogative $\neg?q$: there is no compelling evidence for q (outer negation) or there is compelling evidence against q (inner negation)

evidence for either q or $\neg q$. For example, when browsing the internet, a user may come across web sites asking *Do you not have any friends? (Then click here...)* or *Have you not been able to receive credit from your financial institution to back up your business activities? (Contact...)*. Given that the creators of the web sites have no prior information about the user's private life or financial situation, they could not possibly pose their questions based on prior evidence. Rather, they seem to use negative polar questions instead of the positive ones because the truth of the negative proposition ('I don't have any friends' or 'I have not been able to receive credit') is relevant for the user's decision.

Another counter-example to the weak presupposition proposal is that of a context biased with respect to a proposition in which, nevertheless, a bi-polar interrogative can be asked. Thus in (14), B can easily follow A's utterance with a bi-polar interrogative if she thinks that A may be knowledgeable of the answer, even though there is a weak presupposition in the context for *Bill killed the neighbor's dog.* Similarly, in (15), the speaker can use both a positive polar interrogative or a bi-polar one in a context biased for the proposition with the positive polarity (if we assume that bias can also be generated by inferences).

(14) a. A: *Mike thinks that Bill killed the neighbor's dog.*
b. B: *Well, did he kill it or not?*

(15) a. A: *Jay claims that the political situation in X is too unstable.*
b. B: *What do you think - is it safe to go there or not?*

Finally, positive polar interrogatives can be used in contexts containing both positive and negative evidence, if the speaker just received some information which is in conflict with her previous beliefs, as in (16-b) and (17-b), or, even more strongly, in (16-c) with contrastive accents. Note that the bi-polar variants (16-d) and (17-c) in these contexts appear to be rather odd.

(16) a. A: *I think you should leave.*
b. B: *Are you telling me to leave?*
c. B': *Are YOU telling ME to leave?*
d. B": *Are you telling me to leave or not?*

(17) a. Marie: *I'm going to study in Tromsø.*
b. Marie's mother: *Is there a university in Tromsø?*
c. Marie's mother': *Is there a university in Tromsø or not?*

To sum up, at this point, neither the semantic proposal that positive, negative and bi-polar interrogatives have different denotations, nor the pragmatic proposal that they occur in context with different weak presupposition, can stand closer scrutiny. Let us, therefore, consider the data again.

The examples discussed so far show that there are two factors that appear to influence the choice of polar interrogatives over bi-polar interrogatives (or *vice*

versa): the broader conversational *goals* (as in the questionnaire examples or in (7-a) and (8-a)) and the *likelihood* of some proposition being true (as in (9-b), (10-a), (16-b) and (16-c), and (17-b)). Put differently, the first group of examples is biased in that the speaker wishes to reach a certain state (e.g., one in which the addressee will marry him or the passenger will show him her train ticket), while the second group of examples is informationally biased, in that the speaker wishes to confirm some facts that she finds unexpected or surprising. A way of capturing both these features in the formal representation (while keeping their semantics uniform), as suggested by [Nilsenová and van Rooy, 2002] and [van Rooy and Šafářová, 2003], is to use a decision-theoretic approach to pragmatics. In this approach, both beliefs and preferences or desires of conversational participants can be represented explicitly.[11]

4.3.2 A Decision-Theoretic Alternative

In decision theory, an agent's belief-desire state is modeled as a tuple $\langle P, U\rangle$, where P stands for the agent's probability function, which represents her beliefs, and U for her utility function,[12] which together with P models her preferences.

Two special cases of what the utility function depends on can be considered (for technical details, see the appendix D): one, where the agent wants to know what her actual world is like (the *informational* utility/bias) and another, where the agent has the desire/goal to be in a particular world (the *desired-state* utility/bias).

Then the utility value of the proposition q will be higher than the utility value of learning the proposition $\neg q$ in two possible scenarios:

1. the information value of q is higher than the information value of $\neg q$ because q is less expected to be true than $\neg q$;

2. the probability of reaching the goal g is higher if q is true than if $\neg q$ is true.

By analogy with the weak-presupposition proposal discussed above, one could assume that the question $?q$ will be asked if learning q would be most useful for the agent, while the question $?\neg q$ will be raised if $\neg q$ is most useful (to know to be true); the bi-polar $?(q \text{ or } \neg q)$ would then apply in cases where q and $\neg q$ would be equally useful. In any case, the addressee should be able to recognize the speaker's conversational goal, encoded in the question, and address it.[13]

[11] The decision-theoretic approach to semantics and pragmatics of natural language has been advocated in recent studies (e.g., [Merin, 1999] and [van Rooy, 2003a]) to account for, among others, conversational implicatures and the interpretation of questions.

[12] In Jeffrey's decision theory used here ([Jeffrey, 1965]), utility functions are functions from worlds to real numbers.

[13] One type of examples that shows that conversational participants are able to recognize the conversational goals of others are 'mention-some' readings of constituent questions. For

One prediction of the proposal is that a question $?q$ can be asked in two situations – if the speaker believes $\neg q$ more strongly than q (information bias) and learning q would be surprising, or if the speaker has another conversational goal and learning that q is true will bring her closer to achieving it (desired-state bias).

With this observation, we can now account for the discrepancy between Romero & Han's observation and the description of other authors like Daneš and Ford et al., noted in section 4.2 of this chapter. The expected answer to an interrogative with information bias is the proposition with the opposite polarity (Romero & Han's *Isn't Jane coming?* - expectation: 'Jane is coming.'), while the preferred answer to an interrogative with a desired-state bias is the proposition with the same polarity (*Will you come with us?* - expectation: 'You will come with us.') Note that in principle, it is possible for a proposition q both to be highly informative and to take the speaker closer to her goal (if true); in that case, the question $?q$ might contain both information and desired-state bias. It is not clear whether in practice, two conversational goals can be equally relevant for the speaker raising the question, or if one takes precedence over the other (viz. also the discussion of corpus examples below).

Below, it will be shown how the decision-theoretic proposal can deal with the observations regarding the differing use of positive, negative and bi-polar interrogatives.

Positive Polar Interrogatives

Two examples of positive polar interrogatives with desired-state bias are (7-a) or (8-a), repeated below under (18) and (19):

(18) *Will you marry me?*

(19) *May I see your ticket?*

Interrogatives expressing desired-state bias naturally have the role of requests, invitations, pleas and offers. The goal g of asking a question $?q$ is for q to become true (e.g., for the addressee in (7-a)/(18) to marry the addressee).

As for positive polar interrogatives with informational bias, as already noted above, their utility comes down to informativity of their answer. The most obvious examples of this kind are tag questions such as (20), where the polarity of a tag question contrasts with the polarity of the previous sentence uttered by the same speaker.

(20) *John isn't such a bad guy, is he?*

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example, if a hotel guest inquires *'Where can I buy stamps?'*, the receptionist would presumably direct him to the nearest post office, rather than list all places in the world of which she knows that they sell stamps.

In this case, the speaker takes the declarative sentence to be most likely true. Therefore, the information that the opposite holds (i.e., the proposition contained in the tag question) would be surprising, in other words, have high information value. Questions that check whether some recently received (situational or linguistic) information is really true like (9-b) or (10-a), repeated here under (21) and (22) can also be explained in terms of informational bias.

(21) a. A: *I just saw David.*
b. B: *Is David back from Toronto?*

(22) [to someone who just came in with a dripping umbrella]
Is it raining?

What these examples appear to have in common is that the agent is asking to confirm information that is surprising given her prior beliefs, i.e., if true, would have a high informativity.

Negative Polar Interrogatives

As already mentioned above, there are two types of negative polar interrogatives (viz. [Ladusaw, 1979], [Ladd, 1981b]) which differ in their use of negation in a very subtle way. According to [Ladusaw, 1979] and [Ladd, 1981b], in one case, sometimes referred to as 'outer negation', the function of the negation is to turn the question into a polite suggestion of the opposite polarity, in the other case, sometimes referred to as 'inner negation', the role of the negation is to negate the proposition contained in the question. The two types are exemplified below, with (23-b) containing outer negation and (24-b) exemplifying inner negation:

(23) [Elisabeth and Bob are looking for a restaurant, they just passed a vegetarian one.]
a. Elisabeth: *So where would you like to eat tonight?*
b. Bob: *Isn't there a vegetarian restaurant here?*

(24) [Bob - a vegetarian - is at a conference in Toulouse. Elisabeth is a local.]
a. Elisabeth: *You won't have an easy life here. The traditional meal in southern France is based around meat.*
b. Bob: *Isn't there a vegetarian restaurant here?*

Romero & Han attempt to account for this difference by assuming that in (23-b), an epistemic operator VERUM scopes over negation, while in (24-b), negation scopes over VERUM. Under the decision-theoretic account advocated here, both (23-b) and (24-b) are simply examples of informationally biased polar interrogatives. Consider (23-b) with outer negation: the speaker thinks that there is probably a vegetarian restaurant in the area and learning that it is not so would be surprising. Similarly, in (24-b), the speaker would be surprised to learn that

$\neg q$ is the case. The difference between (23-b) and (24-b) is only that in (24-b), the speaker is confronted with some evidence which he does not immediately ground because it is in conflict with his previous beliefs. This fact is not peculiar to negative polar interrogatives, rather, the difference between (23-b) and (24-b) reflects a difference between uses of questions in general. In particular, (24-b) functions very much as the positive polar interrogatives in (9-b)/(25), (10-a)/(26), (16-b)/(27) or (17-b)/(28), which serve to check prior to the grounding of information that is in conflict with speaker's prior beliefs, while (23-b) is more comparable to the use of tag questions with opposite polarity, such as (20)/(29).[14]

(25) *Is David back from Toronto?*

(26) *Is it raining?*

(27) *Are you telling me to leave?*

(28) *Is there a university in Tromsø*

(29) *John isn't such a bad guy, is he?*

Similarly to positive polar interrogatives, it can be assumed that also negative polar interrogatives can contain a desired-state bias, although examples are, admittedly, more difficult to find. One instance are questions taken from medical or environmental questionnaires, where the goal of the questionnaire is to determine, e.g., whether a child is ill or a person behaves in a nature-friendly way. Here, the positive outcome of the test depends on the truth of the proposition contained in the interrogative; in general, if the proposition is false, the information cannot be used to categorize the tested person (e.g., as *ill-healthy*).

Bi-polar Interrogatives

Unlike in the case of simple polar interrogatives, for bi-polar questions the analysis predicts that they contain no evidence of speaker's bias, be it informational or desired-state bias. This way, one can account for the observation that bi-polar interrogatives are not good requests, as in (7-b), or offers, as in (11), because by using the bi-polar variant the speaker seems to be manifesting her indifference towards the outcome. Similarly, their use is not felicitous as tag questions (con-

[14]Romero & Han also argue that all polar interrogatives containing VERUM (be they positive or negative) can be paraphrased as "is it for sure that we should add to the common ground that x". According to them, semantically, a question like $?p$ with VERUM does not give rise to the partition $\{p, \neg p\}$, but rather to the partition $\{\textit{for-sure-CG}_x p, \neg \textit{for-sure-CG}_x p\}$. The interpretation is not intuitive, though, when applied to answers to the VERUM containing questions, because these are supposed to correspond to the elements of the partition. Consider for example, the question *Does John really drink?* Under Romero & Han's account, the answer *no* stands for 'I am not sure that we should add to our common ground that John drinks', but the normal interpretation would just be 'No, John doesn't drink'.

sider (30)) or in other contexts where the speaker clearly has some prior beliefs, as in (16-d) and (17-c), repeated here under (31-b) and (32-c).

(30) *John isn't such a bad guy, is he or not?*

(31) a. A: *I think you should leave.*
b. B": *Are you telling me to leave or not?*

(32) a. Marie: *I'm going to study in Tromsø.*
b. Marie's mother: *Is there a university in Tromsø?*
c. Marie's mother': *Is there a university in Tromsø or not?*

Note, however, that the proposal does not imply that bi-polar interrogatives are always neutral with respect to speaker's desires. In particular, different levels of insistence (as in (33)) can be modeled by rising utility value of both q and $\neg q$, with the relation remaining constant.

(33) a. *Did you buy it or not?*
b. *Did you buy it or didn't you?*
c. *Did you buy it or didn't you buy it?*
d. *Did you or did you not buy it?*

To sum up the claim presented so far, it seems that polar interrogatives can be categorized as in table 4.1 below (where p stands for 'it is cold').

Table 4.1: The proposed categorization of polar interrogatives.

	Example	**Description**
BI-POLAR	*Is it cold or not?*	unbiased; speaker has no prior beliefs concerning p and no desire for p or $\neg p$ to hold
POSITIVE		
WITH INFORMATIONAL BIAS	*Is it cold?*	speaker would be surprised to find out that it is cold
WITH A DESIRED-STATE BIAS	*Is it cold?*	speaker would "like it to be cold"
NEGATIVE		
WITH INFORMATIONAL BIAS	*Is it not/Isn't it cold?*	speaker would be surprised to find out that it is not cold
WITH A DESIRED-STATE BIAS	*Is it cold/Isn't it cold?*	speaker would "like it not to be cold"

In the following subsection, a number of actually attested examples from a conversational corpus of American English are examined and classified from the point of view of the taxonomy.

4.3.3 Ecological Data

How do real data fit into the taxonomy? In order to examine the taxonomy's applicability, as well as observe possible links to certain intonational patterns, 86 examples of polar interrogatives were selected from the Santa Barbara Corpus of Spoken American English, one-half of them rising in the sense of the feature GunlogsonB, i.e., non-falling from the last pitch accent in the nuclear phrase and ending higher than the level of the nuclear pitch accent, and the other half lacking the feature.[15] Both auditory and instrumental analyses (with PRAAT) of the utterance were used to determine how an utterance was to be classified (i.e., GunlogsonB present or absent). Apart from seeking balance between utterances with and without the intonational feature, the criteria for selection were syntactic completeness (i.e., only interrogatives containing a subject and a full predicate were included), no overlap with other participants' speech and reasonable sound quality. Both positive and negative polar interrogatives were included in the sample, together with tag questions. No suitable examples of bipolar-interrogatives were found and these were thus excluded from the study. Given that positive polar interrogatives were significantly more frequent in the corpus than negative polar interrogatives and tag questions (of both kinds), all of the found negative polars and tag questions that satisfied the criteria for completeness and quality were included in the sample. In the final selection, there were 77 positive polar interrogatives (4 reversed polarity tag questions and 73 non-tag interrogatives) and 9 negative polar interrogatives (5 reversed polarity tag questions and 4 non-tag interrogatives). The utterances were sampled from 15 different conversations, with 29 different speakers (11 male, 18 female).

Using the transcript of the corpus, the selected utterances were categorized as either expressing INFORMATION BIAS, DESIRED STATE BIAS, or UNCLEAR, for utterances which did not appear to fit into either of the categories or where the bias was unclear due to lack of information about speaker's knowledge and preferences in the conversation transcript. The categorization was done by a single annotator (the author).[16] The tables C.2 and C.3 through to C.6 in the appendix give the classification of all the 86 utterances.

As the table indicates, the only subgroup of interrogatives for which some

[15]The feature GunlogsonB was here considered as the only definition of final rising intonation; for practical reasons, ToBI annotations of the utterances could not be made.

[16]No other willing and reliable (given that the annotated features were quite abstract) annotators could be find at that point. Nevertheless, the results of the study – although they have to be taken with a spoonful of salt – were interesting as the first step towards an empirical testing of the taxonomy presented above.

utterances were classified as desired-state biased were positive non-tag polars. The fact that no reversed-polarity tag questions were categorized as desired-state biased is expected, since the most obvious categorization of this type of an interrogative is as information biased question (speaker states she believes ϕ and immediately questions her belief by asking $\neg\phi$, i.e., a question containing the proposition the truth of which would be unexpected).[17] As for negative polar questions, they were rare in the corpus and all the instances found favored the information-biased interpretation. Below, examples are given of the two types of positive/negative polar interrogatives, i.e., with information bias and with desired-state bias, as attested in the data, including some observations relevant with respect to the claims presented in the initial section to this chapter.

The example in figure 4.1 shows a rising positive polar interrogative with information bias (34-c) and with the GunlogsonB feature present (the contour is non-falling from the nuclear (last) accent on *know* and ending higher than the level of the accent). The interrogative was classified as expressing information bias, because the context indicated that the speaker, Joanne, considers a nearby town having a *zocalo* (a little central plaza) as something exceptional.

(34) a. JOANNE: *There is a town right around here that is- still has a zocalo, that's built around a zocalo. You were telling me about that.*
b. KEN: *Oh that was right th- well that was Sonoma.*
c. JOANNE (to Lenore): *Sonoma still has a zocalo. Did you know that? It really does.*

The same sentence – *Did you know that?* – uttered by a different speaker, but also expressing information bias, can be found with the GunlogsonB feature absent. In 4.2, it can be seen that the pitch falls after the first accent and rises again on the final syllable of the utterance; the speaker's pitch range is very narrow but, crucially, for the unvoiced part of the utterance for which the pitch tracker does not give a contour, an auditory impression is that of a fall on the boundary. The context is given in (35-a); the utterance was classified as expressing information bias because, as in (34-c), the speaker appears to be conveying – in her mind – unexpected news.

(35) a. MARCI: *Edna's left our church. Did you know that? Did she tell you?*
b. WENDY: *Hmm.*
c. KEVIN: *Hmm.*

A positive polar interrogative with desired-state bias and the GunlogsonB feature

[17]For same polarity tag questions, as in (i), the interpretation in terms of speaker's bias is less straightforward.

They hired you, have they?

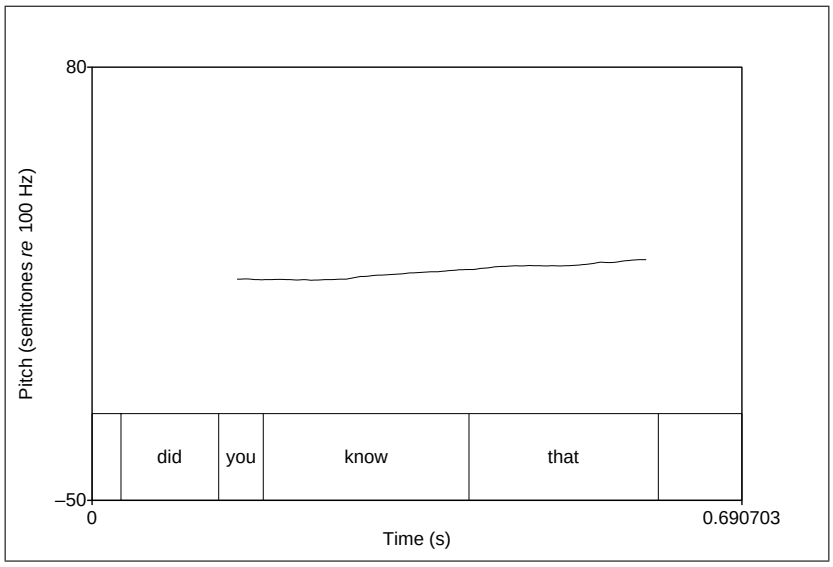


Figure 4.1: The pitch tracking record for the positive interrogative in (34-c).

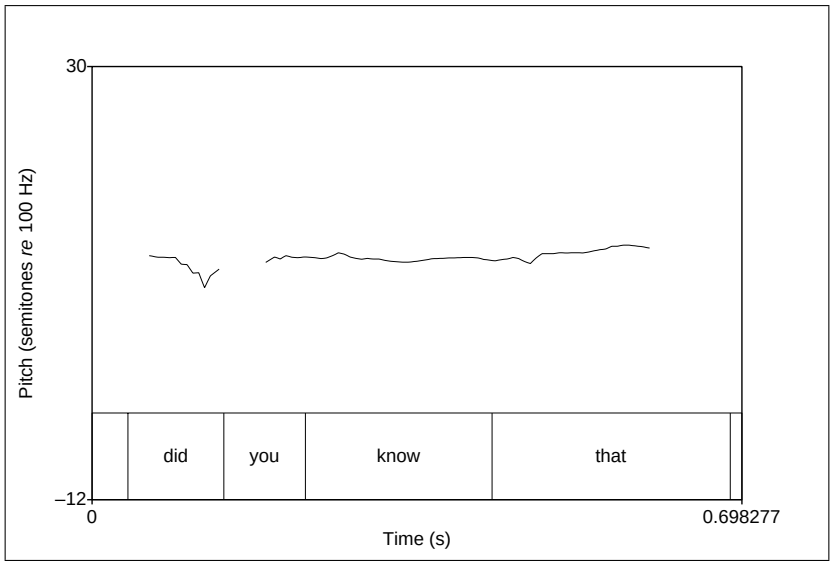


Figure 4.2: The pitch tracking record for the positive interrogative in (35-a).

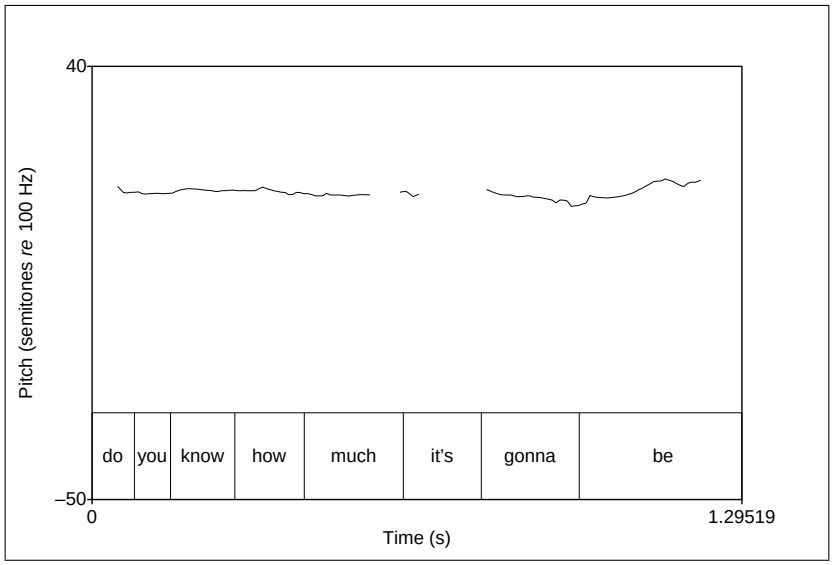


Figure 4.3: The pitch tracking record for the positive interrogative in (36-a).

present[18] is given in (36-a) and the accompanying figure 4.3. In the context, the speaker Rebecca is the attorney of Rickie and her husband and in the fragment below, she inquires about the travel costs of the couple in order to reimburse them. Since knowing the sum is a prerequisite, the interrogative in (36-a) was categorized as desired-state biased.

(36) a. REBECCA: *Do you know how much it's gonna be?*
b. RICKIE: *Oh no, not yet.*
c. REBECCA: *Okay. Um, do you guys have the cash to pay for it right now?*

An example of a positive polar interrogative with a desired-state bias where the GunlogsonB feature was absent (there is a final fall on *too*) is given in (37-a) and 4.4, with a fall from high on '*too*', ending with creaky voice. The interrogative was taken to express desired-state bias in that it appears that in the context, the speaker, Alice, wants her grandmother to have a Christmas tree.

(37) a. ALICE: *Did you get grandma a tree, too?*
b. MARY: *Hunh-unh.*
c. ALICE: *Does she already have one?*
d. MARY: *Hm-m. That pickup could only hold like three.*

No examples of negative polars with desired-state bias were found in the sample.

[18]The appears to be a minor pitch drop on *be*, but perceptually, the end of the nuclear phrase is clearly rising.

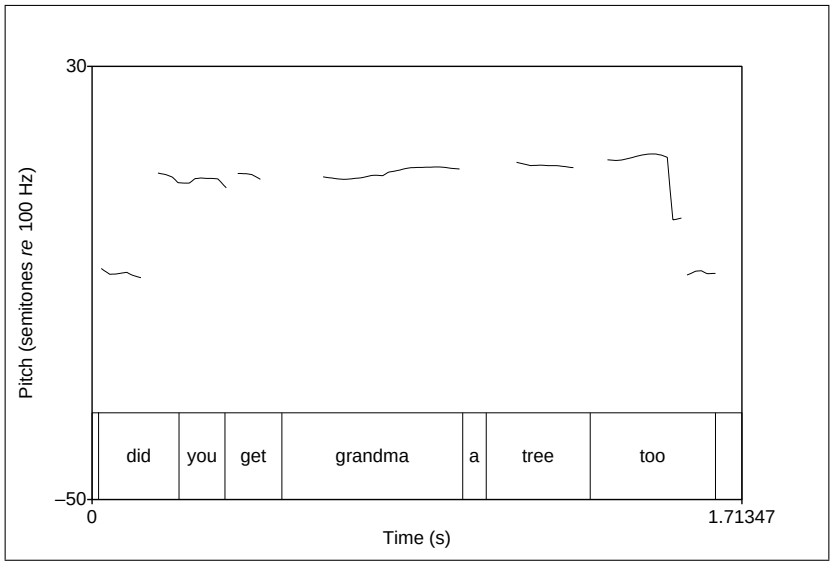


Figure 4.4: The pitch tracking record for the positive interrogative in (37-a).

The next two examples show a negative polar interrogative with information bias. In (38-d), the GunlogsonB feature is present, in that the pitch is non-falling on '*well*' and ends high in the speaker's register, viz. 4.5. In (39-c), after a small rise at the beginning of the word, the pitch is falling from mid on *'late'*, as determined by auditory impression (the pitch contour does not show on the pitch tracker in 4.6).

(38) a. KEN: *That's because it's illegal for Americans to travel to Cuba.* [. . .]
b. JOANNE: *Oh yeah. Just like Lebanon just became.* [. . .]
c. LENORE: *How long has it been illegal?*
d. JOANNE: *Libya, too. Isn't Libya as well?*

The examples in (38-d) and (39-c) were classified as expressing information bias because in both cases, the speaker appears to believe in the truth of the positive proposition - in (38-d), she even states it prior to questioning it, and in (39-c), the speaker, Pete, appears to actually have read the book that is being discussed.

(39) a. ROY: *Do we want to be the guy in charge of the world.*
b. MARILYN: *Unhunh.*
c. PETE: *On the other hand, isn't he saying it's too late?*
d. ROY: *Well he is kind of saying it's too late.*
e. PETE: *So-*
f. ROY: *This is why it's such a depressing book.*

Recall that some authors have argued that rising tag questions (interpreted

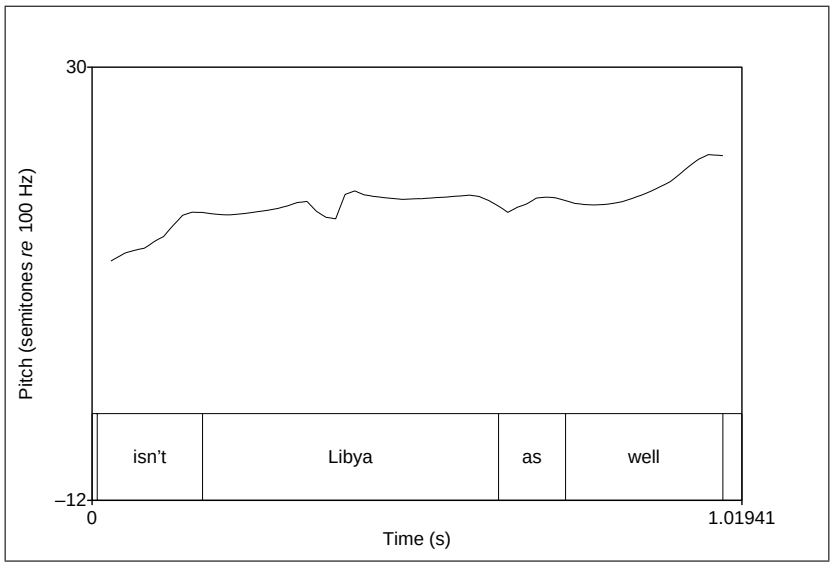


Figure 4.5: The pitch tracking record for the positive interrogative in (38-d).

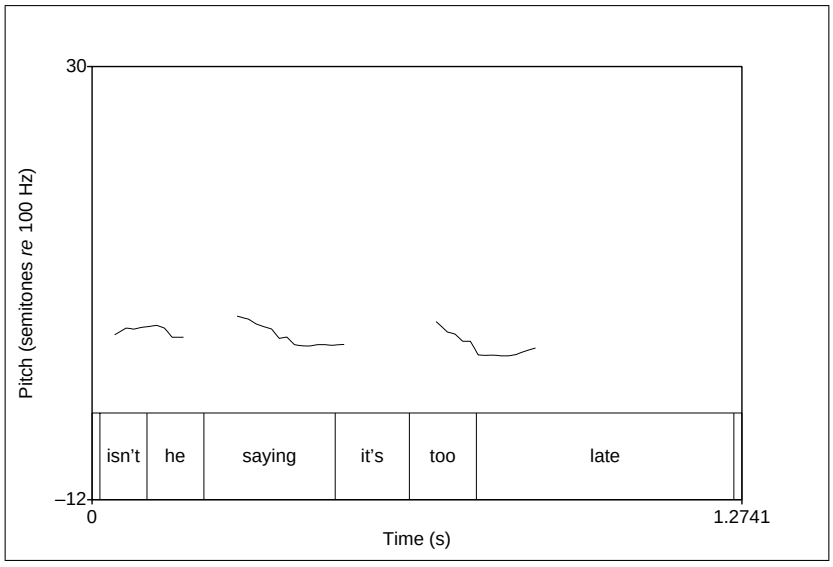


Figure 4.6: The pitch tracking record for the positive interrogative in (39-c).

here as tag questions with the GunlogsonB feature) differ from falling tag questions (i.e., with the GunlogsonB feature lacking) in that only the first kind is a "true" question, the second kind being assertion-like. One would thus expect that these two types would not appear in the same kind of context. Given that the sample of tag questions found in the corpus was very small, no statistically reliable conclusions can be drawn in the present study. Two representative examples by the same speaker, however, can be given, showing that rising and falling tag questions (at least if rise is interpreted as GunlogsonB and fall as the lack of it) can, in fact, play a similar role in conversation. In the fragments below, Nathan, the speaker, is being tutored by Kathy on math.

(40) a. KATHY: *You have to ha- bring,*
b. NATHAN: *Well I can do – find one side by doing that, can't I?*
c. KATHY: *Yeah but, why don't you p- just put the other – put –*

(41) a. KATHY: *I meant once you bring it over there.*
b. NATHAN: *I know what you meant. I don't ever remember us doing anything like that though.There's like a way you always can get rid of those absolute value bars in problems, isn't there? Can I use some of this?*
c. KATHY: *Oh. Yeah. Mm. See, yeah. Here it's absolute values. Right here.*

As visible from the pitch tracking records below, in (40-b) (in the figure 4.7), the pitch is falling on the boundary of the tag questions. In the second case (41-b), the pitch (in 4.8) is very clearly rising on the tag, ending high in the speaker's register (which is overall very narrow and his average pitch quite low). Both tag questions have separate nuclei. In fact, in the sample of cases examined here, none of the tag questions appeared to lack a nucleus and the claim of [Ladd, 1981b] that rising tag questions with no separate nucleus are unbiased ("true questions") thus could not be tested.

As for the problematic cases categorized under *unclear* with respect to the type of bias, this was mainly due to three problems. The most common one was that for some utterances both the information bias and desired-state bias seemed to be possible interpretations (viz. the examples indexed as $\bullet_a$ in the tables C.3 – C.6 in the appendix). For example, the utterance in (42), or in (43) can be interpreted as either expressing the speaker's wish that the answer were 'yes' or as biased towards the negative proposition; in these cases, the context does not help to disambiguate the meaning.

(42) *Did you have any furniture yet?*

(43) *KKSF - does that mean anything to you?*

The other set of problematic cases were utterances which did not appear to

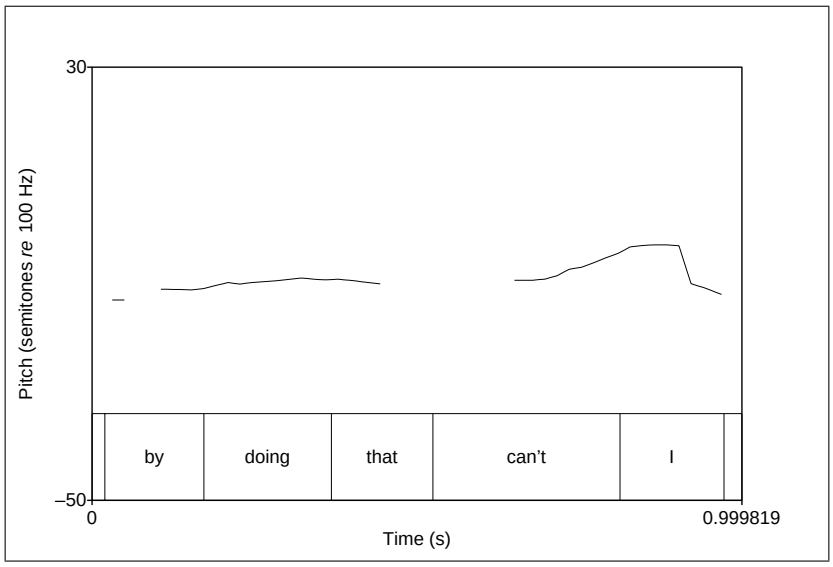


Figure 4.7: The pitch tracking record for the tag question in (40-b).

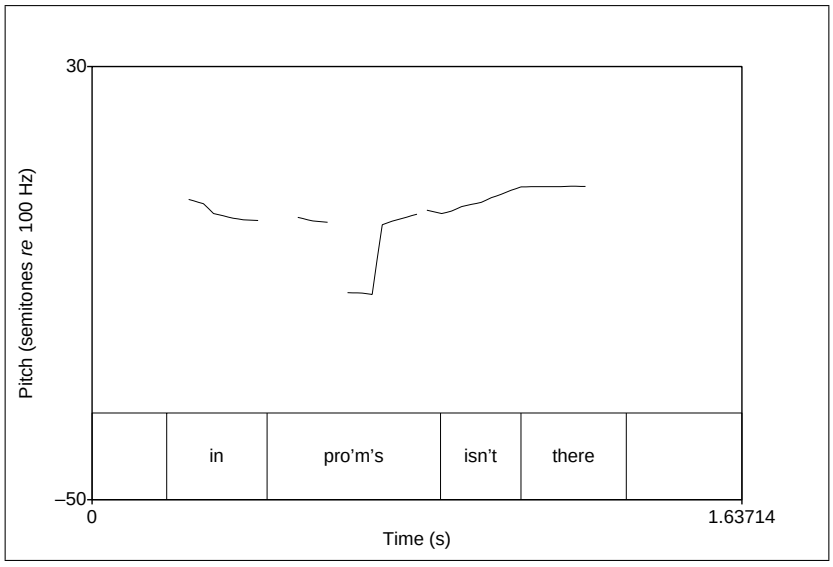


Figure 4.8: The pitch tracking record for the tag question in (41-b).

belong to any of the two categories (viz. the examples indexed as $\bullet_b$ in the tables C.3 – C.6 in the appendix), such as the rhetorical questions (44-a) and (44-b) below.

(44) a. MONTOYA: *Are we less democratic?*
b. MONTOYA: *Are they more democratic?*

Finally, the most interesting type of problem were positive polar interrogatives which appeared to express informational bias for the *positive* proposition to be true (viz. the examples indexed as $\bullet_c$ in the table C.3 – C.6 in the appendix), while according to the decision-theoretic account advocated above, information-biased interrogatives should be biased for the opposite polarity. One example is given in (45-a), where the speaker draws a conclusion from the previous conversation.

(45) a. *So is that why you went to Africa?*

The primary goal of the corpus study was to test the introspective-data based taxonomy summarized in the table 4.1 against real speech examples. On the basis of the speaker's bias estimated from the context of the utterance, the categorization appeared to be applicable for a large number of the interrogatives in the sample. Problems were posed by three types of cases: examples where the context did not contain sufficient amount of information regarding speaker's knowledge and preferences and the utterance thus could not be safely classified; rhetorical questions; and what appeared to be information-biased positive polar interrogatives with bias for the proposition of the same polarity (instead of opposite polarity, as predicted by the theory).

As already noted above, all the examples of negative polar interrogatives were classified as expressing information bias (viz. the table in 4.2).[19] This fact suggests that negative polar interrogatives, not very frequent in the first place in natural conversations, are even harder to be found when expressing desired-state bias. It is not immediately obvious why that should be the case.

The table 4.3 shows that for both GunlogsonB present and absent, the most frequent classification was "interrogative expressing information bias". The numbers, however, are not statistically significant if we compare the association of information-biased interrogatives with GunlogsonB present/absent, excluding the *unclear* cases (with χ^2_1=1.507, p=.22), or even including the *unclear* cases on the side of non-information-biased interrogatives (with χ^2_1=1.163, p=.28). This result indicates that the presence/absence of the GunlogsonB feature is not linked to a bias of one or another kind in an obvious way. There is also no tendency for the association of the GunlogsonB feature (or its absence) with either positive or negative polar interrogative, respectively (the frequency counts are given in table

[19]The numbers are statistically significant, with Yates' χ^2=7.942 and p<.01 for the 2x2 table where *unclear* were counted as non-information-biased, and Yates' χ^2=4.751 and p=.03 for the table where *unclear* were left out.

4.4), with Yates' χ^2_1=0 and Yates' p=1 (Yates' correction was employed because at least 20% of the expected frequencies were below 5). Note again, though, that the results concerning possible links between intonation and expressed bias are by no means final, given that the categorization by bias type was done by a single judge, that not all utterances could be safely classified and that the taxonomy could not account for the existence of certain types.

Table 4.2: Classification of positive/negative interrogatives.

POSITIVE INTERROGATIVE	**77**	information bias	34
		desired-state bias	27
		unclear	16
NEGATIVE INTERROGATIVE	**9**	information bias	9
		desired state bias	0
		unclear	0

Table 4.3: The categorization of selected polar interrogatives by the presence of the GunlogsonB feature and the expressed bias.

			Type of bias	
GunlogsonB	PRESENT	43	information bias	24
			desired-state bias	11
			unclear	8
	ABSENT	43	information bias	19
			desired-state bias	16
			unclear	8

To sum up, in this section, we have seen a categorization of polar interrogatives based on the decision-theoretic notions of information and desired-state bias. The categorization seemed to work reasonably well for examples from the literature and could successfully account for the fact that different types of polar interrogatives are not always freely interchangeable in context, as well as for the observation that some interrogatives are biased with respect to the answer of the same polarity, while others show bias for an answer of the opposite polarity. When tested on data from a conversational corpus, however, it turned out that the taxonomy predicts the existence of polar interrogatives that are hard to find and, on the other hand, denies the existence of types that could be attested (in particular, information-biased positive polar interrogatives with bias for the

Table 4.4: The categorization of positive/negative interrogatives.

		GunlogsonB	
POSITIVE INTERROGATIVE	**77**	present	39
		absent	38
NEGATIVE INTERROGATIVE	**9**	present	4
		absent	5

proposition of the same polarity, instead of opposite polarity, as predicted by the theory). While the first problem could be explained away by data sparsity, the second problem indicates that the taxonomy has to be revised. In particular, it seems that positive polar interrogatives – by far the most frequent type – are the default forms to ask a polar question. Finally, perhaps not surprisingly, no obvious link was found between a type of bias and rising or falling intonation (interpreted in terms of the GunlogsonB feature).

In the next section, the relation between rising/falling intonation and the interpretation of interrogative questions was tested experimentally in a perceptual categorization task.

4.4 Experimental study

As discussed in section 4.2 of this chapter, some authors associate falling intonation on simple polar interrogatives with informational bias (e.g., [Sadock, 1974], [Rando, 1980] or [Millar and Brown, 1979] for reversed polarity tag questions), while others take it to be related to a desired-state bias (e.g., [Daneš, 1960], who suggests that the interpretation of such questions resembles commands). I will take as the null hypothesis that there is no relation between bias in the sense described above and sentence-final melody.

4.4.1 Introduction

A web-based experiment was run from the IRIT, University of Paul Sabatier, designed to test the null hypothesis formulated as:

- *There is no association between intonation in the nuclear phrase of a polar interrogative and the perception of speaker's bias.*

From an intonational perspective, the focus of the experiment were the features *high boundary tone (H%)* and *GunlogsonA* (i.e., rise in the nuclear phrase defined

Table 4.5: Positive polar interrogatives used as stimuli in the categorization task from chapter 3 (excluded stimuli marked with '*').

1.	Is it raining?
2.	Have you seen her?
3.	Does it matter?
4.	Will Jane come?
5.	Is he married?
6.	Does she like it?
7.	Will we make it?
8.	Did you hear it?
9.	Is it certain?
10.	Is it better?
11.	*Are you crazy?
12.	*Can I help you?

in terms of MAE-ToBI as H*H-H%, L*H-H%, L*H-L% and L*L-H% by Gunlogson), together with the definition examined in the corpus study (GunlogsonB feature). To circumvent some of the difficulties observed above (i.e., the default-like nature of positive polar interrogatives compared to bipolar and negative polar ones), only positive polar interrogatives were used in the experiment.

4.4.2 Method

The stimuli used in the experiment were 12 read interrogative utterances (viz. the list in 4.5 below), each with 8 different ToBI contours (H*H-H%, L*H-H%, L*L-H%, L*H-L%, L*L-L%, H*L-H%, H*L-L%, H*H-L%), the first four of which were categorized as having the GunlogsonA feature and the subsequent four as lacking it. All the interrogatives were mono-clausal with the sentential structure auxiliary-subject-predicate, with the last pitch accent in the nuclear phrase falling on the penultimate syllable in the utterance. To ensure that the utterances used in the task carry the ToBI contours of interest, a professional female MAE-ToBI annotator with experience in producing naturally-sounding stimuli was asked to record several realizations of the target utterance in a sound-proof booth. In cooperation with the speaker, the recordings were instrumentally and perceptually analyzed. As experimental stimuli, we selected those realizations which best corresponded to the assigned ToBI contours. Of the 96 stimuli, 16 were excluded from the final analysis due to their idiomaticity (the realizations of examples *Are you crazy?* and *Can I help you?*, indicated with an asterisk in 4.5).

Twenty-six native speakers of American English participated in the experiment, thirteen male and thirteen female, 17-36 years old. They were all students

of linguistics on undergraduate and graduate level; the linguistic undergraduates, who were from the University of Texas, Austin, received course credits for their participation. The participants accessed the experiment online and received the instructions to evaluate the presented stimuli from the perspective of perceived expectations: did they have the impression that they could detect the speaker having certain expectations about the answer to her question, be it positive or negative? Based on their judgment of the perceived expectations, they could categorize the stimulus utterance on a 5-point scale: *[the speaker] definitely expects 'no' – probably expects 'no' – [has] no expectations – probably expects 'yes' – definitely expects 'yes'*. They could also make use of a 'remark'-window into which they could write their observations and possible difficulties with interpreting the stimuli. On average, the judges took about 13 minutes to perform the task.

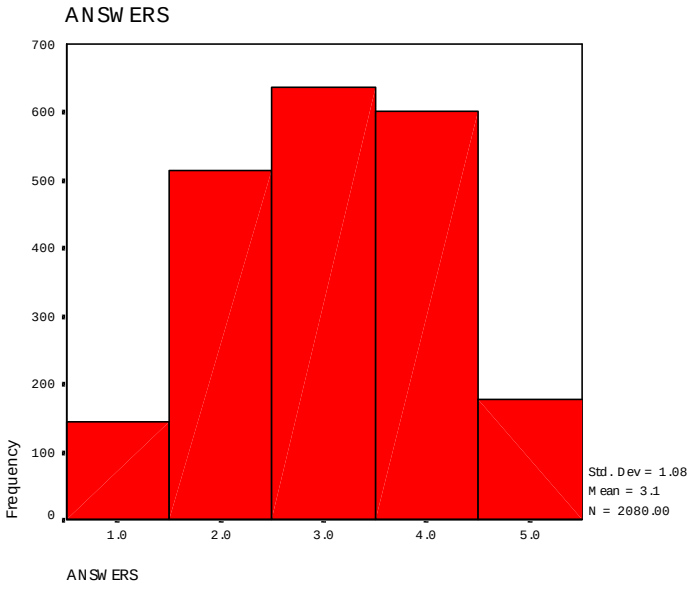
The assumption was that the replies *the speaker definitely/probably expects 'no'* indicate a perceived informational bias (for a proposition of opposite polarity), the response *the speaker has no expectations* will correspond to no perceived bias and, finally, the responses *the speaker definitely/probably expects 'yes'* will reflect perceived desired-state bias (for a proposition of the same polarity).

4.4.3 Results

The received judgments were first compared for overall agreement among judges with the kappa statistic; it was found that the inter-annotator agreement was quite poor. In 20 cases out of 325 ($k(k-1)/2$) the kappa coefficient was between $.21 - 40$ ('fair'), in the rest of the cases, it was $.00 - .20$ ('poor'), viz. [Landis and Koch, 1977]. In their responses, the judges overall tended to avoid the extremes of the five point scale, with proportionally only .07 and .09 of the responses being *definitely 'yes'* and *definitely 'no'*, respectively. The general distribution of answers across subjects is shown in the figure 4.9 and the accompanying table in the appendix, C.7. The frequencies of the five types of responses (*[the speaker] definitely expects 'no' – probably expects 'no' – [has] no expectations – probably expects 'yes' – definitely expects 'yes'*) were compared for each of the eight MAE-ToBI contours. As shown in the table in 4.6, proportionally frequent were the matches between 'speaker definitely expects 'no" and the contour L*L-L% and between 'speaker definitely expects 'yes" and the contours L*H-H% and H*H-H%. Also, one-fourth of the responses 'speaker has no expectations' was matched to the contour H*L-L%. The contour - response pairs that were statistically significant (using χ^2, with $p < .01$) are printed in bold in the table. Note that the contour L*H-L% was not significantly associated with any particular type of answer.

When the five types of responses were grouped according to the perceived bias as 'information bias' (*1,2*), 'no bias' (*3*) and 'desired-state bias' (*4,5*) and matched to the eight different ToBI patterns (viz. the frequency table 4.7), no particularly frequent match was found, with the already reported link between the contour

Figure 4.9: The distribution of answers across subjects.



H*L-L% and 'no bias' being the largest (.25). A number of tendencies can be observed, though, e.g. that of H*H-H% not to be associated with information bias – unlike L*L-L%. No highly frequent match was found between the individual contours and the responses grouped as 'bias' (*1,2,4,5*) and 'no bias' (*3*), viz. table 4.8, again with the exception of H*L-L%.

Subsequently, the responses to the eight contours were divided into two groups, based on the presence or absence of a high boundary tone (H%). The frequencies of the five types of responses were first compared individually; as shown in 4.9, more than two-thirds of the response 'speaker definitely expects 'yes" (desired-state bias) was given in case a high boundary tone was present. Note also that if one considers the five types of responses as a continuum, the "closer" to speaker's definite positive expectations, the higher the proportion of H% cases. In order to explore the possible link between the presence of a high boundary tone and perceived expectations from another perspective, the responses *1, 2, 4* and *5* were again grouped together under 'bias' (i.e., 'speaker definitely/probably expects 'yes'/'no"). As the table 4.10 shows, the proportion of the 'bias'-responses to H% was more or less the same as to L% (.51) and the proportion of the 'no-bias'-responses (i.e., responses of type *3*) was also more or less the same to the two types of boundary tones (.57 to H%).

To seek the perceptual patterns for the set of ToBI contours labeled here as GunlogsonA, the stimuli were grouped into two classes based on the ToBI contour they carried (viz. 4.11 below). For the responses *1,2,3* and *4* treated

Table 4.6: Responses (by proportion) to types of polar interrogative contour (*1 - speaker definitely expects 'no'; 2 – speaker probably expects 'no'; 3 – speaker has no expectations; 4 – speaker probably expects 'yes'; 5 – speaker definitely expects 'yes'*).

Response	N	HHH	HHL	HLL	HLH	LLL	LLH	LHH	LHL	Total
1	146	**.03**	.13	**.05**	**.01**	**.38**	.14	.16	.10	1
2	514	**.07**	**.20**	**.07**	.10	.15	**.19**	.08	.14	1
3	638	.12	**.08**	**.25**	**.18**	**.06**	.14	**.04**	.13	1
4	603	**.17**	.12	**.08**	**.13**	.11	.16	.10	.13	1
5	179	**.25**	.08	**.05**	.07	.12	**.08**	**.30**	**.05**	1

Table 4.7: Responses (by proportion) to types of polar interrogative contour by negative/no/positive bias.

Response	N	HHH	HHL	HLL	HLH	LLL	LLH	LHH	LHL	Total
InfoBias	660	.06	.18	.07	.08	.20	.18	.10	.13	1
No Bias	638	.12	.08	.25	.18	.06	.14	.04	.13	1
DesSt Bias	782	.19	.11	.07	.12	.11	.14	.15	.11	1

individually, the frequencies were more or less the same for the presence/absence of the GunlogsonA feature (viz. table 4.12), for the response *5* (definite positive, i.e., desired-state bias), the proportional frequency was higher when the feature GunlogsonA was present (.68). There was a (statistically significant[20]) tendency to associate GunlogsonA with a biased interpretation (viz. above, for details, see tables 4.13 and 4.14).

Finally, all the 80 tested stimuli were categorized for the presence of the feature GunlogsonB, using the auditory and instrumental method already employed in the corpus study described in the previous section. Of the 80 stimuli, 45 were categorized as having the feature and 35 as lacking it; the table 4.15 shows how different ToBI contours were divided. The analysis of the ToBI contours showed that the ToBI set characterized by Gunlogson (i.e., the feature GunlogsonA) does not always correspond to the contour-based definition of the final rise (GunlogsonB). Only the contours H*L-H%, H*L-L%, L*L-L% and L*L-H% behaved as predicted (the first three being always G-falling and the fourth always G-rising); the other four contours were less regular (in figures C.3, C.4, C.5 and C.6 in the appendix I give examples of contours which did not satisfy the definition of GunlogsonB). However, as with the feature GunlogsonA, also for GunlogsonB there was a statistically significant tendency to associate with a biased interpretation (especially the desired-state bias), viz. table 4.16, 4.17 and 4.18.

[20]With a χ^2 test and $p < .01$.

Table 4.8: Responses (by proportion) to types of polar interrogative contour by bias.

Response	N	HHH	HHL	HLL	HLH	LLL	LLH	LHH	LHL	Total
Bias	1442	.13	.14	.07	.10	.15	.15	.13	.13	1
No Bias	638	.12	.08	.25	.18	.06	.14	.04	.13	1

Table 4.9: High boundary tone and answer crosstabulation (*1 - speaker definitely expects 'no'; 2 – speaker probably expects 'no'; 3 – speaker has no expectations; 4 – speaker probably expects 'yes'; 5 – speaker definitely expects 'yes'*).

Response	N	H% Present	H% Absent	Proportion (present)
1	146	50	96	.34
2	514	222	292	.43
3	638	307	331	.48
4	603	336	267	.56
5	179	125	54	.70
Total	2080	1040	1040	.50

4.4.4 Discussion

The methodology utilized in this experiment involved stimuli read with predetermined ToBI contours by a MAE-ToBI expert. One difficulty noted with the carrier sentences was the fact that the last pitch accent in the nuclear phrase always fell on the penultimate syllable in the utterance. This turned out to be problematic for the production of the L*H-L% contour; post-hoc, it appeared that in order to contrast it reliably with the L*H-H% and L*L-H% contours, it would have been better to place the nuclear pitch accent on the antepenultimate syllable or yet further away from the terminus. The realization of the contour may have been the reason why it was not significantly associated with any particular type of answer (in a positive way). Also, the speaker was asked to produce all utterances starting in the mid-range of her register which may have created

Table 4.10: High boundary tone and bias crosstabulation.

Response	N	H% Present	H% Absent	Proportion (present)
Bias	1442	733	709	.51
No Bias	638	307	331	.57
Total	2080	1040	1040	.50

Table 4.11: Categorization by GunlogsonA.

Present	Absent
L*H-H%	H*L-H%
H*H-H%	H*H-L%
L*L-H%	L*L-L%
L*H-L%	H*L-L%

Table 4.12: GunlogsonA and type of response crosstabulation (*1 - speaker definitely expects 'no'; 2 – speaker probably expects 'no'; 3 – speaker has no expectations; 4 – speaker probably expects 'yes'; 5 – speaker definitely expects 'yes'*).

Response	N	GunlogsonA Present	GunlogsonA Absent	Proportion (present)
1	146	63	83	.43
2	514	246	268	.48
3	638	273	365	.43
4	603	336	267	.56
5	179	122	57	.68
Total	2080	1040	1040	.50

an unwanted effect with the L*L-L% utterances, as it was sometimes difficult to distinguish the L* from a complex downstepped high pitch accent.

The results of the experiment both shed a new light on the association between pitch and bias and confirm some existing claims. Against the prediction of the taxonomy proposed in section 4.3, it appears that positive polar interrogatives can be interpreted as carrying no bias – in fact, this was the most frequent interpretation by the judges (viz. the histogram in 4.9). Admittedly, the classification was based on the perceptual impression of context-less interrogatives and this result thus does not necessarily imply that speakers also *produce* unbiased positive polar interrogatives (and/or that the bias is not recognized in conversation).

In general, both the GunlogsonA and the GunlogsonB feature were associated

Table 4.13: GunlogsonA and bias crosstabulation.

Response	N	GunlogsonA Present	GunlogsonA Absent	Proportion (present)
Bias	1442	767	675	.53
No Bias	638	273	365	.43
Total	2080	1040	1040	.50

Table 4.14: GunlogsonA and information/no/desired-state bias crosstabulation.

Response	N	GunlogsonA Present	GunlogsonA Absent	Proportion (present)
Information Bias	660	309	351	.47
No Bias	638	273	365	.43
Desired-state Bias	782	458	324	.59
Total	2080	1040	1040	.50

Table 4.15: Categorization of different ToBI-contours by the GunlogsonB feature.

Contour Type	GunlogsonB Present	GunlogsonB Absent
H*H-H%	208	52
H*H-L%	78	182
H*L-H%	0	260
H*L-L%	0	260
L*H-H%	208	52
L*L-H%	260	0
L*L-L%	0	260
L*H-L%	156	104

with bias. (Definite) information bias (i.e., expectations of a negative answer) was by far the most frequently given response to utterances with the contour L*L-L%. As for desired-state bias (i.e., expectations of a positive answer), it appeared to be perceptually associated especially with contours with a high phrase and boundary tone. In fact, the definite expectation of a positive answer was proportionally most frequent with the low-rising and high-rising tune (i.e, more than a half of the 'speaker definitely expects 'yes" responses had the L*H-H% or H*H-H% tune) and with the high boundary tone (70% of the utterances classified as 'speaker definitely expects 'yes" and more than a half of those classified as 'speaker probably expects 'yes" had a H%, compared to 34% of the utterances judged as 'speaker definitely expects 'no"). The null hypothesis stated in the beginning of this section thus was not supported by the results of the perceptual experiment.

4.5 Conclusion

In this chapter, I first discussed some observations that can be found in the literature regarding the interpretation of rising interrogatives (including reversed-

Table 4.16: Responses (by proportion) to the contours categorized by the GunlogsonB feature (*1 - speaker definitely expects 'no'; 2 – speaker probably expects 'no'; 3 – speaker has no expectations; 4 – speaker probably expects 'yes'; 5 – speaker definitely expects 'yes'*).

		1	2	3	4	5	Total
GunlogsonB	absent	.09	.25	.35	.25	.06	1
	present	.05	.25	.25	.34	.11	1

Table 4.17: Biased/unbiased responses cross-tabulated with GunlogsonB.

	GunlogsonB Present	GunlogsonB Absent	Proportion (present)
Bias	677	765	.47
No Bias	233	405	.37

polarity tag questions) on the one hand, and their falling counterparts on the other hand. I showed that there is a discrepancy between the intuitions of the authors, in that according to some of them, falling polar interrogatives are often biased towards a response with the same polarity, while others note that they are biased for a response of the opposite polarity. The discrepancy can be explained if we assume that there actually exist two kinds of bias, one based on speaker's desires (*desired-state bias*), where the speaker wishes the proposition of the same polarity to be true, and one based on speaker's beliefs (*information bias*), where the speaker expects the proposition with the opposite polarity to hold. A pragmatic, decision-theoretic account can be used to represent the two types of bias formally.

The theoretical description was summarized in terms of a taxonomy of polar interrogatives which was also examined on conversational speech corpus examples. It turned out that real-life data do not confirm the predictions of the taxonomy on at least one count (apart from the difficult classification of some utterances), namely the existence of information-biased positive polar interrogatives with bias for the proposition of the same polarity (instead of opposite polarity, as predicted by the theory).

Subsequently, the results of a perceptual categorization task designed to test the association between nuclear tunes and types of bias were reported. Both the GunlogsonA and the GunlogsonB feature were found to be associated with bias (in particular, desired state bias). It was also observed that expectations of a negative answer (the information bias) were most frequently perceived with the low-falling tune in the nuclear phrase (L*L-L%). The expectations of a positive answer (i.e., the desired-state bias), on the other hand, appeared to be perceptually associated especially with the low-rising (L*H-H%) and the high-rising (H*H-H%) tune and with the high boundary tone. Finally, the contour H*L-L% was

Table 4.18: Negative bias/no bias/positive bias responses cross-tabulated with GunlogsonB.

	GunlogsonB		
	Present	Absent	Proportion (present)
Information Bias	271	389	.41
No Bias	233	405	.37
Desired-state Bias	406	376	.52

mostly interpreted as an indicator that the speaker has no particular expectations of a positive or negative answer. In general, the most frequently given response in the experiment was that the interrogative stimulus carried no bias regarding the expected answer. Although this result does not necessarily imply that a large number of (positive) polar interrogatives are also *produced* without bias, it again signals that the taxonomy of polar interrogatives may need to be revised. For example, it may be stipulated that positive polar interrogatives can be used as default interrogatives and their particular function is conveyed with the help of intonational features.

Chapter 5

Semantics for English Final Rises

5.1 Introduction

In the previous two chapters, we have had a closer look at the types of utterances that have been associated with rising intonation. We have identified a set of rising contours which help the recognition of evaluative response-seeking declaratives (a.k.a. "declarative questions") and further examined their use and interpretation on polar interrogatives. Making use of all the previously discussed empirical findings, the main goal of this chapter is to argue for a particular semantic analysis of the final rises in American English as 'intonational adverbs'.

In particular, it will be suggested that the properties of the final rises (L*H-H%, H*H-H% and L*L-H%) can be captured in a uniform way if we take its meaning to be a direct linguistic correlate of its paralinguistic effect, namely an expression of uncertainty. One way to express the meaning formally is in terms of Veltman's $\diamond$-operator, defined originally for expressions such as *it might be that* as introducing *tests* on the content of the common ground. Since Veltman's update semantics lacks the question operator, an extension of the original system will be proposed here which includes question semantics for propositional formulas. In the extended system, rising declaratives will be represented as $\diamond\phi$-types of statements, rising interrogatives as $?\diamond\phi$ and falling interrogatives and declaratives as $?\phi$ and ϕ, respectively. The fact that $\diamond\phi$-types of statements are response-seeking (and usually receive a reply from the addressee) will be ascribed to the effect of the maxims of rational conversation. In particular, it will be argued that the maxims of quality, quantity and relation force the participants to address the issue under discussion and to make the strongest possible statement given their state of knowledge.

One advantage of the proposal is that it allows for the relation between syntactic and semantic types to be kept uniform. In other words, all syntactic declaratives can be analyzed as assertions and the category of 'declarative questions' can be discarded; this leads to a conceptually simpler system. The fact that

rising declaratives are analyzed as (weak) assertions together with the maxim of relation also explains why they appear to express an epistemic bias of the speaker towards the the truth of the proposition. Related to this result of combining update semantics with Grice's maxims is also that the system allows to account pragmatically for what is sometimes considered a weak point of Veltman's semantics for possibility, namely that statements of the kind $\diamond\phi$ are not redundant in discourse. Also, the interpretation of the final rise as an expression of epistemic uncertainty links its linguistic meaning directly to its paralinguistic interpretation, observed in a number of earlier studies. It follows straightforwardly from the analysis that rising declaratives are sometimes interpreted as indicating politeness, tentativeness and other affective states.

In the section immediately below, the relevant empirical observations regarding the use of the final rise are summarized. The summary then serves to evaluate the existing theoretical proposals regarding the meaning of rising intonation, in particular the approaches of Pierrehumbert & Hirschberg, Merin & Bartels, Gunlogson and Steedman. In section 5.4., the formal proposal is formulated using update semantics combined with the question operator. In the final part of the chapter, directions for future research are discussed in detail.

5.2 Summary of empirical observations

In the previous chapter, the term 'final rise' was used as a cover term for three closely related properties of the nuclear phrase, i.e., the GunlogsonA feature, the GunlogsonB feature and the high boundary tone (H%). It was the GunlogsonA feature that was found to be most frequently associated with response-seeking utterances (in chapter 3) and also with desired-state bias (in chapter 4) and the semantics proposed here will primarily be concerned with this particular interpretation. Expressed in the broad ToBI notation, it will be the denotation of the contours L*L-H%, L*H-H%, H*H-H%, with the fall-rising L*H-L% excluded.[1] I do not dismiss the possibility that individual tones that compose the tunes L*L-H%, L*H-H%, H*H-H% have some additional meaning that interacts with the meaning formalized here.

In order to simplify the notation, I will write ↑ for the three GunlogsonA contours in the examples discussed below and leave unmarked sentences with contours which do not belong to the set and are thus, from the present perspective, 'falling'.

Notation:

- ↑ = '(final) rise' = { L*L-H%, L*H-H%, H*H-H% }

[1]The contour L*H-L% was not sufficiently attested in the data in the experiment described in chapter 3, so its status is not entirely clear.

- (no notation) = '(final) fall = { H*L-H%, L*L-L%, H*H-L%, H*L-L% }

(1) Final rise is possible but not necessary with polar interrogatives.

The first observation is based on the result of the corpus studies reported in chapter 2, and was behind the experimental data used in chapter 4 which encompassed both GunlogsonA and non-GunlogsonA contours. Three examples of rising polar interrogatives from the Santa Barbara Corpus with the contours subsumed here under the GunlogsonA feature are given in (1) (fig.5.1), (2) (fig.5.2) and (3) (fig.5.3) with their accompanying pitch tracks and broad ToBI labels; in (4) I give an example of a falling interrogative (fig.5.4).

(1) *Do you have a salad spinner?*

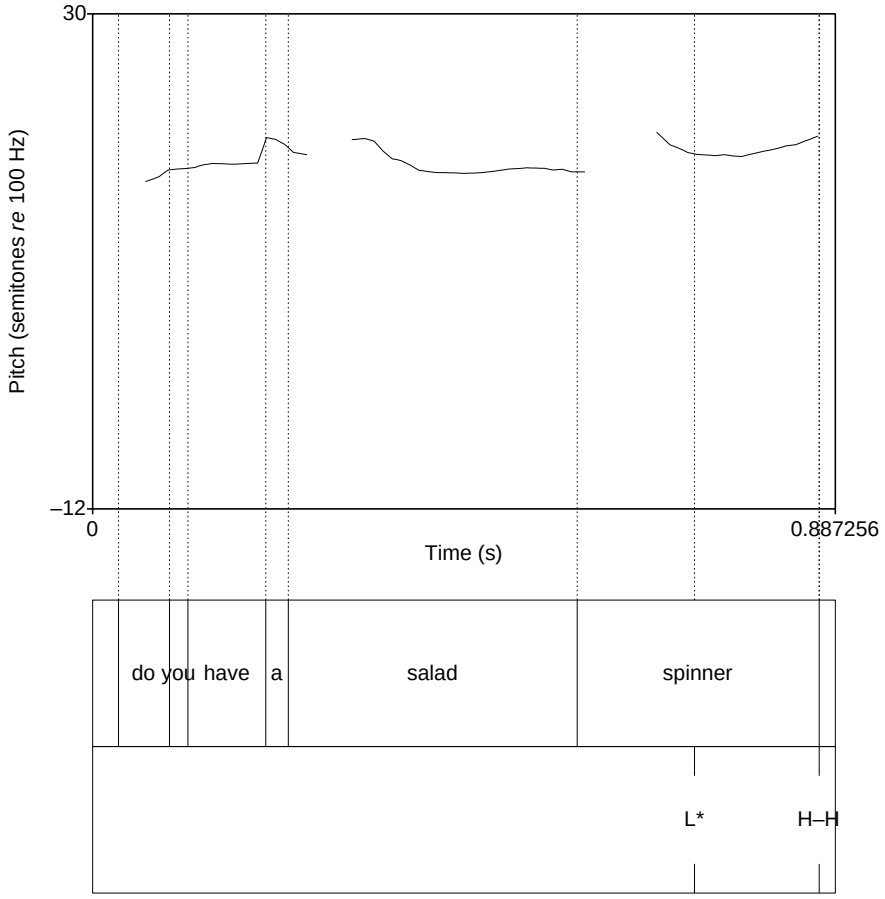


Figure 5.1: A low-rising interrogative (example (1)).

(2) *Is that what it's called?*

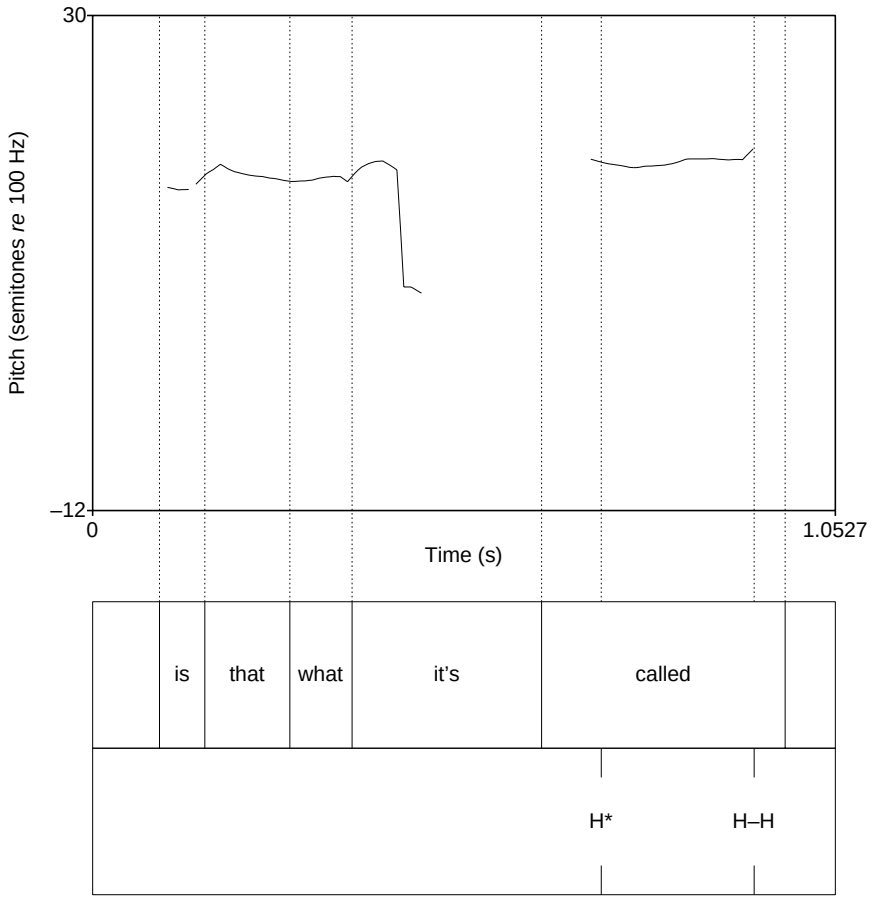


Figure 5.2: A high-rising interrogative with narrow range (example (2)).

(3) *Is that attached onto a storage facility?*

(4) *Is that what we tell the world?*

(2) Final rise is possible on declaratives.

Apart from the introspection-based examples offered by [Gunlogson, 2001], the corpus examples used in the experimental task from chapter 3 show that ↑-declaratives occur in free conversations. Three examples are given in (5-c), (6-d)

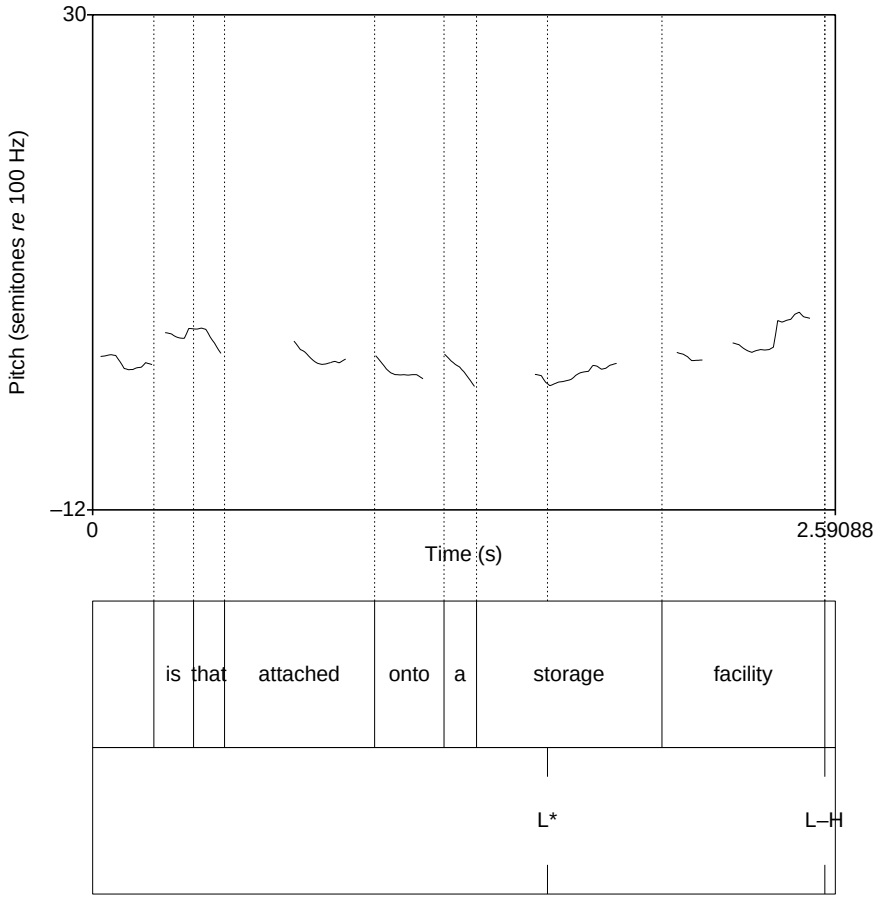


Figure 5.3: A low-rising interrogative with narrow range (example (3)).

and (7-b), with their accompanying context. The example in (5-c) (for which the figure C.7 in the appendix shows its pitch contour and the aligned ToBI labels) was annotated as high-rising and classified as an acknowledgment-seeking declarative. The example in (6-d) (viz. figure C.8 in the appendix for the pitch track and a ToBI annotation) is low-rising and was classified as a proper declarative (not response-seeking). (7-b) (viz. figure C.9 in the appendix) was labeled as low-rising with narrow range and categorized as evaluative response-seeking.

(5) a. Jim: *Now I think a hundred fifty dollars is a lot to maintain a self-directed IRA.*
b. Fred: *Mhm. So you mean that you–*
c. (Fred:) *we could pass that back to the customer.*
d. Jim: *Right.*

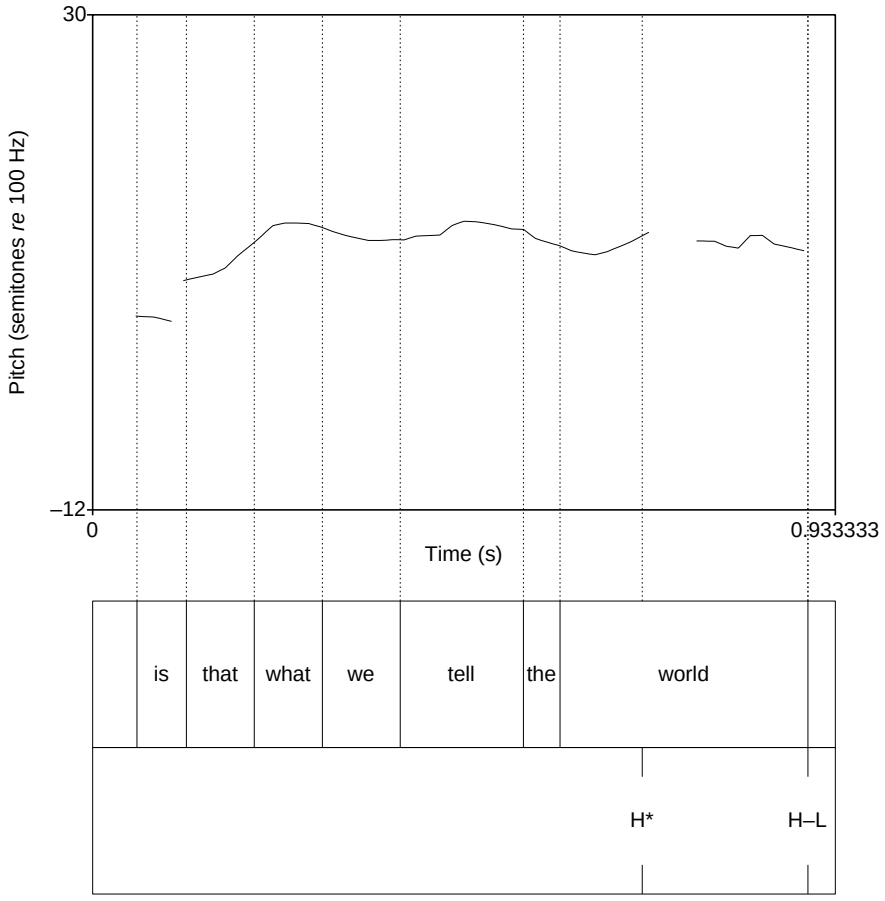


Figure 5.4: A falling (i.e., not GunlogsonA) interrogative with a stylized-high rise contour (example (4)).

e. Fred: *That's what you're saying.*
f. Jim: *Right.*

(6) a. Jim: *that's what I thought that they did anyways.*
b. Michael: *Yeah?*
c. (Michael:) *Hunh.*
d. (Michael:) *They certainly use her a lot.*
e. (Michael:) *But I mean it– they only use, what?*

(7) a. Alice: *he was going to uh, Peggy –*
b. (Alice:) *you remember Peggy White?*
c. Mary: *Yeah.*

(3) Some ↑declaratives commit neither the speaker, nor the addressee to their truth.

As an example can serve the evaluative response-seeking declarative in (7-b), where the speaker is asking a biased question, with regard to which the addressee is considered to have expert knowledge. Another example is the try-out statement in (8-b) from [Gunlogson, 2001] (p. 88) where the speaker is stating a likely hypothesis:

(8) a. Speaker A: *John has to leave early*
b. Speaker B: *he'll miss the party then*↑

(4) Some ↑declaratives commit the speaker to their truth.

An example of a ↑-declarative that commits the speaker to its content is (6-d) above, which was classified as a proper declarative. Another example is the presumably high-rising (9) due to [Pierrehumbert, 1980], (10-b), originally from [Hirschberg and Ward, 1995], and (11).[2]

(9) [to a receptionist]
Hello, my name is Mark Liberman↑

(10) a. DJ: *Good morning Susan. Where are you calling from?*
b. Caller: *I'm from Skokie*↑

(11) *My name is Carl*↑ *I'll be your waiter tonight*↑

[McLemore, 1991b] reports a number of similar examples in her corpus of sorority speech, as in (12) where the speaker conveys new information but wants to keep contact with the addressee. Informative statements expressing polite, submissive and/or uncertain attitude, such as (13-b) from [Pierrehumbert, 1980], can also be classified into this category.

(12) a. Speaker A: *I put a sign-up sheet over on the board*↑
b. Speaker B: *it's for Dad's Day*↑

(13) a. Speaker A: *how did you like the movie?*
b. Speaker B: *I thought it was good*↑

(5) Some ↑declaratives are only used if the addressee is already committed.

A typical example are echo questions, such as (14-b) from [Gunlogson, 2001]:31. The acknowledgment-seeking declarative in (5-c), repeated here under (15-c) is an example of addressee's commitment based on a weaker inference than in the case of echo questions.

[2]Both (10-b) and (11) are cited by [Gunlogson, 2001]:27.

(14) a. Speaker A: *that copier is broken*
b. Speaker B: *it is↑ thanks, I'll use a different one*

(15) a. Jim: *Now I think a hundred fifty dollars is a lot to maintain a self-directed IRA.*
b. Fred: *Mhm. So you mean that you–*
c. (Fred:) *we could pass that back to the customer↑*
d. Jim: *Right.*
e. Fred: *That's what you're saying.*
f. Jim: *Right.*

(6) ↑declaratives are (evaluative) response-seeking.

This observation is based on the results of the experiment reported in chapter 3, where it was found in particular that the ↑ feature was perceived as a signal of the evaluative response-seeking function. It was also observed, however, that the final rise was neither sufficient, nor necessary for an utterance to be understood in this way. Below, examples of utterances that were not response-seeking or not perceived that way but were rendered with a high-rising contour are repeated under (16-b) and (17-d).

(16) a. Melissa: *Just two more. Actually, that.*
b. Jan: *okay, I'm gonna check on you in ten minutes↑*
c. (Jan:) *if you haven't gotten one page done in ten minutes you'll go*
d. Melissa: *One side of a page? It takes me a long time,*
e. (Melissa:) *because I've got to go over the sentences*

(17) a. Montoya: *to mobilize large numbers of people,*
b. (Montoya:) *into some kind of a effort or movement.*
c. (Montoya:) *. . . Alright.*
d. (Montoya:) *So he's correct↑*
e. (Montoya:) *It depends on the time, depends on the circumstances. . .*

(7) ↑declaratives are not interchangeable with polar interrogatives.

This observation has been discussed extensively by [Gunlogson, 2001] who shows that in a context, rising declaratives often cannot replace polar interrogatives (and *vice versa*). Gunlogson notes that unlike polar interrogatives, ↑declaratives convey an epistemic bias of the speaker towards the truth of the proposition, which is why (18-b) is unacceptable as an unbiased exam question and (19-b) as a question at a committee hearing.[3]

(18) [as an exam question]

[3]The # symbolizes a semantically/pragmatically anomalous sentence.

a. *Is the empty set a member of itself?*
b. *# The empty set is a member of itself*↑

(19) [at a committee hearing]
a. *Are you a member of the Communist Party?*
b. *# You're a member of the Communist Party*↑

(8) ↑utterances are considered to be more polite and friendly.

One interpretation of rising intonation that forms a part of Gussenhoven's *Frequency Code* discussed in chapter 2 is speaker's polite and/or friendly attitude (see also [Uldall, 1964] and, especially, [Gussenhoven, 2004] and [Chen, 2004] for discussion). The rising interrogative in (20) would thus presumably be perceived as more polite/friendly than the falling interrogative in (21).

(20) *can I help you*↑

(21) *can I help you*

(9) The paralinguistic interpretation of ↑ is uncertainty.

Another effect of the use of rising intonation that the *Frequency Code* was designed to capture is that it often signals uncertainty or lack of confidence on the part of the speaker ([Ohala, 1983], [Ohala, 1984], [Cruttenden, 1997], [Gussenhoven, 2004], a.o.). Compare the minimal pair below, with a falling (22-b) and its rising version in (22-c), originally from [Pierrehumbert, 1980]. While in (22-b), the speaker B simply states her opinion, in (22-c) she does so in a way which implies that she is uncertain of her opinion or if it will be accepted by speaker A.

(22) a. Speaker A: *what did you think of the movie?*
b. Speaker B: *I thought it was good*
c. Speaker B': *I thought it was good*↑

(10) ↑ is not associated with continuations.

This observation is based on the results of the experiment reported in chapter 3. There, continuation was interpreted as "the speaker just continues talking without expecting to receive or receiving a reply from the addressee". The contours that contributed to the recognition of evaluative response-seeking were not associated with this kind of contextual follow-up in a statistically significant way. This finding was taken to signify that what in the literature is referred to as a continuation rise (as in (23) symbolized by →) and is associated with discourse incompleteness and openness is not the same as the rise associated with evaluative response-seeking utterances.

(23) *I don't want shrimp → I want lobster.*

(11) The meaning of ↑ is "strong".

Another finding of the experiment in chapter 3 was that in a task in which judges had access both to the recording of an utterance and to its transcript, intonational features appeared to be "stronger" than other utterance features (e.g., the presence of a hetero-cognitive predicate or an utterance-initial particle). At least with respect to evaluative response-seeking interpretation, some intonational features, especially GunlogsonA, played a statistically significant predictive role, while the lexical-pragmatic features were not significant. This is despite the fact that the presence of a hetero-cognitive predicate significantly contributed to the evaluative response-seeking interpretation in the task with *no access* to prosodic information.

(12) ↑ polar interrogatives are associated with desired-state bias.

In the perceptual experiment described in chapter 4, it was found that (positive) polar interrogatives with the GunlogsonA feature were frequently perceived by listeners as interrogatives to which the speaker expects an affirmative answer. In the decision-theoretic framework outlined there, these interrogatives were taken to assume primarily desired-state bias, in that the affirmative answer expresses a proposition that the speaker wishes to be true. For example, the affirmative answer to the polar interrogative in (24) expresses the proposition that 'Jane will come'. If (24) was rising, listeners tended to interpret the proposition 'Jane will come' as something that the speaker wishes to hear as an answer.

(24) *Will Jane come?*

Note also that utterances which were clearly lacking the GunlogsonA feature – especially those with the contour L*L-L% – were most strongly linked to the interpretation of speaker expecting a negative answer to her question or having no expectations.
In an ideal case, a semantic theory of the final rise should account for all the facts listed above. In the following subsections, I will discuss several existing semantic proposals from this perspective, including additional empirical observations where they are of relevance.

5.3 Existing Proposals

5.3.1 Pierrehumbert & Hirschberg (1990)

Recall from chapter 2 that Pierrehumbert & Hirschberg in their system assign meaning to individual tones and assume that the meanings combine in a com-

positional way. As for the high-rising tune, H*H-H%, they suggest that it is used in questions which at the same time convey new information – the tune is forward-looking (H-, H%) and the accented item is new in discourse. The low-rising L*H-H%, on the other hand, is a forward-looking tune that does not convey new information (the L* tone indicating that the unit carrying the pitch accent is old news). As for the low-rising tune with narrow range, L*L-H%, its meaning in the system appears to be contradictory, since the L- phrase tone indicates that the intonational phrase should not be interpreted together with what follows, while the high boundary tone H% is forward-looking. Disregarding this difficulty, the system does not capture other meanings associated with the use of the rise (viz. observations (8) and (9)) and wrongly predicts that there should be a link between the "question tunes" and continuation rise (cf. observation (10)).[4] Despite the fact that the meanings assigned to tones serve to express the relation between a proposition and the mutual beliefs of the conversational participants (the common ground), it is not obvious why it should be the case that ↑declaratives can have different effects on the content of the common ground (observations (3), (4) and (5)). Also, McLemore ([McLemore, 1991a] and [McLemore, 1991b]) gives examples from her corpus of checking statements (i.e., statements conveying new information where the speaker uses the final rise because she wants to maintain contact with her audience) with L*H-H%, as in (25). She notes that "[the speakers] often use L*[with a high boundary] in the first intonational phrase of a monologue when other participants are assumed to have equal rights to the speaking floor" (p. 79). It is unclear how Pierrehumbert & Hirschberg's description would apply to these contexts, given that the L* tone is supposed to be conveying old information.

(25) $y'all\ I\ was\ gonna\ tell_{L*}\ y'all_{H-H\%}$

Note also that Pierrehumbert & Hirschberg's system does not explain why rising declaratives are not interchangeable with interrogatives (observation (7)), though one could argue that this is due to a difference between interrogatives and declaratives in general, disregarding their intonational properties.

5.3.2 Merin & Bartels

[Merin and Bartels, 1997] and [Bartels and Merin, 1998], based on Merin's 'algebra of social acts' ([Merin, 1994]), assume that a conversation is a bargaining game in which the players are concerned with establishing the content of their common ground [Stalnaker, 1978]. Each state in the game can be described with four parameters, with the value 'Speaker' or 'Addressee' – **actor-role [S], pref-**

[4] If the interpretation of 'continuation' used here is not the same as, or subsumed by the notion 'forward-looking', it is not immediately obvious what the function does in a semantic or pragmatic sense.

erence [P], dominance [D], and **initiator role [I]**, and a fifth parameter for the **proposition** under discussion [Θ].

Preference indicates which of the two communicating agents prefers adoption of the proposition Θ. [Merin, 1994] makes the assumption that the preference is strict and converse, i.e., if one agents prefers Θ, the other agent prefers $\neg\Theta$. Note that having a preference for Θ does not necessarily mean having the belief that Θ is true (although in practice, it is often the case); the assumption is thus relatively harmless and expresses the intuition that if agents' preferences were not opposed, there would be no issue to discuss.

Dominance is basically the bargaining power of agents, a notion explored, among others, by [Hintikka and Sandu, 1997]. Roughly, in the specific setting of conversations, an agent A would dominate (have power over) another agent B with respect to a proposition Θ, if A dominates B socially, and/or if the utility of adopting Θ is higher for B than not adopting Θ. This can be either direct, or indirect, when not adopting Θ would mean (not) adopting other propositions with loss of utility. In many settings, dominance can be related to the reliability of the source of information (well-informedness and credibility of agents, e.g., [ten Cate and Šafářová, 2001].

[Merin, 1994] considers only the four types of states in which [P]=[I], i.e., the initiator of Θ also has preference for Θ: Claim $< S, S, S, S, \Theta >$, Concession $< S, A, A, A, \Theta >$, Denial $< S, A, S, A, \Theta >$ and Retraction $< S, S, A, S, \Theta >$.

As for the meaning of intonation, note that by associating the dominance parameter to rises and falls, Merin & Bartels attempt to capture formally the reflections of *Frequency Code* discussed in chapter 2. In particular, according to the *Code*, rising melody is, among else, linked to submissiveness and conciliatory attitude, in other words, lack of dominance. Specifically, in the proposal, the combination of a low pitch accent L* with a high phrase or boundary tone (H- and H%, respectively) allocates dominance over the acceptance of a proposition to the listener (while a fall appropriates it).

By giving up dominance, the hearer also fails to assert the proposition contained in her utterance. The system thus correctly predicts that the evaluative response-seeking declarative in (26-b) with a low pitch accent and a high boundary tone should not be interpreted as an assertion by the speaker. At the same time, though, the system also seems to predict that the utterance *does* appropriate the proposition to the speaker and is assertive, because of the presence of the low phrase tone. Similarly to Pierrehumbert & Hirschberg's proposal, the combination of a low phrase tone and a high boundary tone (or, a H- and L%) appears to be contradictory. According to [Bartels and Merin, 1998], however, the tone sequence L-H% *can* receive an interpretation when it follows a high pitch accent (H*; i.e., in case it is a Fall-Rise) and one would assume that the same holds for the tune L*L-H%. It is not clear, though, what the precise interpretation is, because tunes where the pitch accent is the same as phrase/boundary tone (e.g., H* H-, L* L-) are not explicitly treated in the proposal. The tune L*L-H% could be interpreted

both as a simple rise (the L- would be disregarded) or as a Fall-Rise, "embedding one choice allocation under another" ([Bartels and Merin, 1998]:100).

(26) a. Alice: *he was going to uh, Peggy –*
b. (Alice:) *you remember Peggy White?*
c. Mary: *Yeah.*

In effect, the suggested meanings can thus only be tested for their predictive power for cases where the phrasal tone and the boundary tone are identical, especially for the contour L*H-H% (rising in Merin & Bartels' system) and H*L-L% (falling), and for the single case of Fall-Rise (H*L-H%). Here, it turns out that the predictions are not confirmed, since there are declarative utterances with the L*H-H% contour for which it is difficult to argue that the speaker failed to assert them, as in (6-d) repeated below under (27-d).

(27) a. Jim: *that's what I thought that they did anyways.*
b. Michael: *Yeah?*
c. (Michael:) *Hunh.*
d. (Michael:) *They certainly use*$_{L*}$*her a lot.*$_{H-H\%}$
e. (Michael:) *But I mean it– they only use, what?*

On the other hand, there are evaluative response-seeking declaratives which are falling, such as (28-c) with the H*L-L% contour. The example is taken from the acoustic task of the experimental study discussed in chapter 3, in which it was also classified as evaluative response-seeking by a significant majority of judges (see fig.C.10 in the appendix for a visual representation of the $F0$ contour and broad ToBI description).

(28) a. Miles: *No sooner did I think this thought, guys were over there-*
b. Harold: *What-, . . .*
c. (Harold:) *you didn't ask her to dance*$_{H*L-L\%}$
d. Jamie: *Not Miles, he's just in daze.*
e. Miles: *Well I was still trying to figure out,*
f. (Miles:) *surely they must know each other,*

Note that even if the definition of rising (and falling) intonation is changed, the fundamental assumption in Merin & Bartels' system that either the speaker or the addressee have dominance over a proposition goes against the observation (3) which states that some rising declaratives commit neither the speaker, nor the addressee to their content (viz. (8-b), repeated here under (29-b)).

(29) a. Speaker A: *John has to leave early*
b. Speaker B: *he'll miss the party then*↑

In fact, the authors could argue that in (29-b), Speaker B merely allocates

dominance over the expressed proposition to Speaker A, but that does not mean that she commits him to its truth. The undesired consequence of this step is that it no longer seems to be possible to distinguish between rising declaratives and (rising) polar interrogatives (neither commits anyone to its truth, both allocate dominance to the listener). This goes against the observation in (7) which states that the two utterance types are not interchangeable, because rising declaratives express speaker's bias towards the truth of the expressed proposition.

To sum up, the approach of Merin & Bartels can account for most of the observations made in the beginning of this chapter (disregarding the observations (10), (11) and (12) which are not explicitly treated in the proposal). It is, however, incomplete, in that it is not clear what meaning is assigned to tunes like L*L-H% and it appears to make wrong predictions with respect to examples like (28-c). It is also not obvious how the proposal can deal with the observation (3), for reasons explained immediately above.

5.3.3 Gunlogson (2001)

[Gunlogson, 2001] in her dissertation focuses mainly on the instances of final rises on declaratives and makes the following observations:

- Rising declaratives express a bias that is absent with the use of interrogatives; they cannot be used as neutral questions.
- Rising declaratives, like interrogatives, fail to commit the speaker to their content.
- Rising declaratives can only be used as questions in contexts where the addressee is already publicly committed to the proposition expressed ('Contextual Bias Condition').

In the semantics Gunlogson assigns to rises to account for these facts, her approach is closely related to that of [Merin and Bartels, 1997] summarized in the previous subsection, as well as to [Steedman, 2004a] for whom the H% versus L% boundary tone distinction correlates with the 'ownership' of the content expressed (see below for a more detailed description of Steedman's proposal). Specifically, Gunlogson implements the hypothesis that rising declaratives commit the addressee to the proposition expressed, while falling declaratives commit the speaker. First of all, she suggests that the context C can be viewed as composed of the commitment sets of conversation participants, cs:

> **[Context]**
> Let a discourse context $C_{\{A,B\}}$ be $\langle cs_A, cs_B \rangle$, where A and B are discourse participants:
> cs_A of $C_{\{A,B\}}$ = {w ∈ W: propositions representing A's public beliefs are all true of w}

cs_B of $C_{\{A,B\}}$ = {w ∈ W: propositions representing B's public beliefs are all true of w}

The meaning of a rising declarative, ↑ S_{decl} is defined in terms of its context changing potential as:

[Meaning of the Rise]
C + ↑ S_{decl} = C' such that:
a. cs_{spkr}(C') = cs_{spkr}(C)
b. cs_{addr}(C') = cs_{addr}(C) + S_{decl}

For falling declaratives, here marked with ↓, their context changing potential is defined as follows:

[Meaning of the Fall]
C + ↓ S_{decl} = C' such that:
a. cs_{spkr}(C') = cs_{spkr}(C) + S_{decl}
b. cs_{addr}(C') = cs_{addr}(C)

It appears that Gunlogson's description of the rise in terms of changing the commitment set of the addressee does not really capture the observation that rising declaratives are used in contexts in which the addressee is already committed to the truth of the expressed proposition (her 'Contextual Bias Condition'). One example of such use is given in (14-b), repeated here under (30-b) from [Gunlogson, 2001]:31.

(30) a. Speaker A: *that copier is broken*
b. Speaker B: *it is↑ thanks, I'll use a different one*

On the other hand, ↑declaratives are also used and recognized in contexts where the addressee is not publicly committed *to the truth* of the expressed proposition, but at most to *knowing whether* the proposition is true or not, given that he or she is regarded as an expert on the issue, as in (31-b) from the Santa Barbara Corpus (also used in the experiment described in chapter 3). A similar example is that in (8-b), repeated under (29-b) above, where neither the speaker, nor the addressee appear to be committed to its content after it has been uttered.

(31) a. Speaker A: *he had a lot of real wacky ideas on big levels... he wanted a world power system, that you could tap into the air basically, and get power anywhere on earth...*
b. Speaker B: *that's what the Tesla coil was about↑*
c. Speaker A: *yeah, the problem was, that it interfered with, well, matter... I mean, it was not a clean broadcast system*

It is also not correct that rising declaratives always fail to commit the speaker to their content. As already noted above, they can be used as a politeness or

checking device in situations where the speaker is informed with respect to an issue while the addressee is ignorant, as in (9), (10-b) and (11), repeated here under (32), (33-b) and (34), respectively.

(32) [to a receptionist]
Hello, my name is Mark Liberman↑

(33) a. DJ: *Good morning Susan. Where are you calling from?*
b. Caller: *I'm from Skokie*↑

(34) *My name is Carl*↑ *I'll be your waiter tonight*↑

One cannot reasonably claim for these cases that the addressee is either already committed to the truth of the propositions expressed by the speaker, or becomes so committed after they have been uttered (while the speaker does not).

Another objection to Gunlogson's approach is that the analysis does not explain why rising declaratives are usually responded to by the **addressee** (observation (6)). Gunlogson stipulates that uninformativeness with respect to the addressee is a necessary condition for an utterance to qualify as a polar question (i.e., in the terminology here, to be evaluative response-seeking), but not that it is a sufficient condition. Given that the correct use of rising declaratives is presumably a part of the rules of rational conversation exchange and thus mutual knowledge, Gunlogson's analysis would predict a response from the addressee neither in case she disagrees with the proposition – because she would be inconsistent with herself, nor if she agrees with it – because she would be agreeing with what she is already publicly committed to, which is superfluous.[5] If we accept Gunlogson's setup and make the natural assumption that the goal of the conversation is to exchange information and thus create shared commitments, it should make perfect sense that the *speaker* states whether she agrees or disagrees with the proposition contained in the ↑declarative she herself uttered! However, neither seems to be the case in conversation: rising declaratives usually elicit a confirmation or a disconfirmation from the addressee (be it at least in terms of a nod or a short backchannel) and are not commented upon by the speaker.

To sum up, Gunlogson's proposal cannot account for a prevalent number of rising declarative usage types. Specifically, it cannot deal with examples where a rising declarative is used not because the addressee is committed to its content but rather because he or she is regarded as an expert on the issue, examples where it commits the speaker to its content, as well as those were neither the speaker nor the addressee become committed. Also, the approach does not offer a plausible explanation as to why rising declaratives in all of these cases tend to elicit a response from the addressee. As for other meanings associated with the

[5] As a matter of fact, Gunlogson would allow for the second case because for her, a sentence is informative if it is informative at least with respect to one commitment set. Note, however, that this has the unwanted consequence that a participant in a dialogue could repeat a sentence for as long as the addressee does not explicitly agree or disagree with it and still be informative.

rise, such as politeness, friendliness, as well as uncertainty (observations (8) and (9)), they cannot be derived from the suggested context changing potential in any obvious way.

5.3.4 Steedman (2004)

[Steedman, 2004a], building on [Steedman, 1991] and [Steedman, 2000] models speaker's knowledge in a dialogue in terms of two commitment sets, S (speaker's commitments), and H (hearer's commitments) and assumes that "high boundaries [...] identify the hearer as in the speaker's view committed to the relevant information unit" ([Steedman, 2004a]:7). Put differently, the low boundary tone (L%) always indicates that a proposition belongs to the S-set, while the high boundary tone (H%) always indicates a proposition from the H-set.[6] Steedman's system also associates theme and rheme meanings to pitch accents and as a whole is integrated into a Combinatory Categorial Grammar model.

Like Gunlogson, whose proposal was discussed in the previous section, Steedman's system predicts that a proposition necessarily commits either the speaker or the hearer (be it at least in the speaker's eyes). We have seen, however, that there are examples of ↑declaratives (all of them with high boundary tones) which appear to do neither (viz. observation (3) and the example (8-b) there). Similarly, counterexamples can be found both to the claim that a high boundary tone commits the addressee (viz. (6-d)) and a low boundary tone the speaker (viz. (28-c)). Another objection that could be raised is that, unlike Merin & Bartels' approach which explicitly addresses the association of rises with politeness, submissiveness, uncertainty and other attitudes, there is no obvious explanation for this link in the presently discussed account. With respect to the observation (10) concerning continuation rises, Steedman assumes that they are the same as the response-seeking rises, in that continuation is an implicature that follows from the basic sense of high boundaries ([Steedman, 2004a]:7). At least with respect to one particular interpretation of continuation tested in chapter 3, this did not appear to correspond to speaker's intuitions.

5.3.5 Summary

Using the data summarized in the beginning of this chapter, I have argued against some selected descriptions of intonational meaning in English. But the proposals of Pierrehumbert & Hirschberg, Merin & Bartels, Gunlogson and Steedman also provided highly important cues for the formalization outlined in the following section (apart from making predictions regarding the shape of the final rise associated with evaluative response-seeking utterances, already tested in chapter 3).

[6] Like Merin & Bartels, Steedman also assigns meaning to phrase tones that are not followed by boundary tones. I will disregard these cases here.

As for the meaning of ↑, defined more or less as the Gunlogson's set, together with Steedman and others, I will assume that the meaning of the final rise concerns propositional attitudes, i.e., reflecting the status of propositions in the set of mutual beliefs/common ground in the conversation (disregarding information structure, which is not discussed here at all). Moreover, like in Steedman's system, the meaning of the final rise will be made a component of the same semantic system as words and phrases. I will also make use of the idea that rising declaratives often do not commit the speaker to their content, and use pragmatic mechanisms to explain why this is not always the case. Specifically, it will be suggested that the crucial properties of rising declaratives can be captured in a uniform way if we take the meaning of the final rise to be that of a modal expression of epistemic uncertainty and use Grice's maxims to derive their response-seeking effect.

5.4 Final Rise as a Modal Expression

There is cross-linguistic evidence suggesting a connection between questions and expressions of epistemic uncertainty (albeit of a morphological type). As noted by [Palmer, 1986], there are languages that use a 'dubitative' or 'uncertainty' morpheme to turn statements into questions. For example, in Hixkaryana, there are two ways to express non-past - certain and uncertain - and when the 'non-past uncertain' is used alone (without other modal particles), it expresses a question. What is relevant about these and other cases given by Palmer is that in various languages, questions appeared to be expressed with the help of a modal expression which, however, does not express interrogativity by itself or in general.

The connection between final rises and uncertainty has been noted in several studies in the past (a.o., [Uldall, 1964], [Chen and Gussenhoven, 2003], as well as [Chen et al., 2001], [Gussenhoven, 2004]) and other attitudes usually associated with the rise like tentativeness, submissiveness or conciliatory attitude can be seen as secondary derivatives of 'uncertainty'. In many contexts, expressing uncertainty may also sound more polite than a direct statement or a question (cmp. the examples below) because it helps to preserve the addressee's face by giving him more space to refuse a request (e.g., for information), or an update of the mutual knowledge state.

(35) *Could you maybe tell us when you'll be arriving?*

(36) *Maybe we could leave now.*

In earlier proposals, uncertainty and lack of confidence was considered to be a secondary attitude accompanying the primary meaning of rising declaratives, typically taken to be 'questionhood'. Here, it will be suggested that uncertainty is the primary meaning associated with the rises, and questioning comes as a derived pragmatic effect. In particular, the final rise will be analyzed as a kind of

an 'intonational adverb', comparable, for instance to *it might be that*. This allows for an analysis that stays "true to form" at least with respect to declaratives, i.e., it represents all declaratives as statements. It only follows from pragmatic reasoning about the content of the rising declarative that the addressee should comment on it.

The meaning of the ↑ is here formalized within *update semantics*. In update semantics, the meaning of a sentence is defined by "the change it brings about in the information state of anyone who accepts the news conveyed by it" ([Veltman, 1996]:1). This understanding of sentential meaning can be traced back to [Stalnaker, 1974] and has since then become common in formal semantics (see also [Kamp, 1981], [Heim, 1982] and [Groenendijk and Stokhof, 1991]). In the model here, the information state that is being updated is the common ground, as it is perceived by a single conversational agent. It is assumed that in a conversation, agents' information states contain "possibilities" that are all compatible with what they know is true (and, hence, what they know is false, given the underlying two-valued logic). In this setup, a proposition is understood to be a set of "possibilities", namely those where the proposition is true. An update with a proposition p means that the agent can "eliminate" from her information state the (set of) possibilities where p does not hold.

In order to be able to translate both falling and rising statements and questions into the formal language, the original Veltman's update semantics is combined with a simple semantics for questions. Due to the semantics of the $\diamond$, it is not possible to make direct use of the partition semantics for questions (e.g., [Groenendijk and Stokhof, 1996])[7] but I will make use of the idea that questions disconnect worlds in an information state. With respect to the language with the $\diamond$ operator, $L_\diamond$ cannot be embedded under negation or in conjunction/disjunction. In $L_?$, the $\diamond$ can be embedded under ?, the question operator, but stacking and embedding of ? is excluded.

Definition 1. [Language]
Let us define the language L as the set of formulas $\phi ::= p \mid \neg\phi \mid \phi \wedge \psi \mid \phi \vee \psi$, where p ranges over atomic propositional formulas.
Then $L_\diamond$ is the smallest set s.t. $L \subset L_\diamond$ and if $\phi \in L_\diamond$ then $\diamond\phi \in L_\diamond$ and $L_?$ is the smallest set s.t. $L_\diamond \subset L_?$ and if $\phi \in L_\diamond$ then $?\phi \in L_?$.

[7] In the partition semantics for questions, it is assumed that the effect of a polar interrogative on the common ground is that it "partitions" it into sets of propositions that are possible answers to the interrogative. For polar interrogatives, the blocks in the partition are defined by the affirmative answer and the answer with the opposite polarity. E.g., the interrogative *Is it raining?* presumably partitions the common ground into two blocks, one containing the possibilities where it is raining and the other containing the possibilities where it is not raining. An affirmative answer then "eliminates" all the possibilities where the proposition 'It is raining' does not hold. There are a number of restrictions in the partition semantics, viz., e.g., [Dekker et al., 2006] for a brief introduction.

In the new language, we can now have both statements with a $\diamond$, $\diamond\phi$, as well as questions, $?\diamond\phi$, in other words (because I analyze the rise as $\diamond$), we have both rising statements (declaratives), as well as rising questions (interrogatives).[8]

Definition 2. [Context]
Let W be the set of possibilities and V a valuation function which in all $w \in W$ assigns to each propositional letter a truth value 0 or 1. Then a context σ is an equivalence relation on a subset of W, $\sigma \subseteq W \times W$, and $dom(\sigma)$, the domain of a context is the set of possibilities in σ, $dom(\sigma) = \{w \in W \mid (w, w) \in \sigma\}$.

I will write $\sigma/_X$, $X \subseteq W$ for a restriction of a context, such that $\sigma/_X = \{(w, w') \in \sigma \mid w, w' \in X\}$ and I will call $\sigma^0 = W \times W$ the state of complete ignorance and indifference where no statements have been made and no questions asked.

Definition 3. [Semantics]

- $\sigma[p] = \sigma/(dom(\sigma) \cap \{w \in W \mid V(p)(w) = 1\})$
- $\sigma[\neg\phi] = \sigma/(dom(\sigma) - dom(\sigma[\phi]))$
- $\sigma[\phi \wedge \psi] = \sigma/(dom(\sigma[\phi]) \cap dom(\sigma[\psi]))$
- $\sigma[\phi \vee \psi] = \sigma/(dom(\sigma[\phi]) \cup dom(\sigma[\psi]))$
- $\sigma[\diamond\phi] = \sigma$ if $dom(\sigma[\phi]) \neq \emptyset$ and $\emptyset$ otherwise
- $\sigma[?\phi] = \{(w, w') \in \sigma \mid w \in dom(\sigma[\phi])$ iff $w' \in dom(\sigma[\phi])\}$

The first four clauses in the semantics above are defined as usual: The update with the proposition p restricts the context only to possibilities in which the proposition is true. For an update with the negation of a formula, all possibilities in which the formula holds are "eliminated" from the domain; conjunction is defined in terms of an intersection of the conjoined formulas and disjunction is understood as a union. Also the last clause is defined in a standard way: an update with a question "disconnects" pairs of worlds. The fifth clause, i.e., the update with a $\diamond$-formula, however, is crucial for the semantics of the rising intonation. According to the definition, the update with a $\diamond\phi$ is understood as a

[8] [Gerbrandy, 1999] in his dissertation gives a formalization of Veltman's update semantics which allows for $\diamond$ being in the scope of negation. The interpretation of the formula one gets with the semantics is, however, not intuitive: $\neg\diamond\phi$ is interpreted as $\sigma - \sigma[\diamond\phi]$, which is $\emptyset$ if there is at least one ϕ world and σ otherwise. In natural language, however, a statement like 'It is not the case that he might come' would rather be interpreted as conveying the information that 'He is (certainly) not coming', i.e, as an update with $\neg\phi$ (or stronger, if possible in the formal language), not as a contradiction if it is not yet known whether ϕ or not.
One could try to give a fixed interpretation to $\neg\diamond\phi$ formulas as being simply equal to $\neg\phi$, but such a system basically collapses to propositional logic. (Thanks to Bernhard Schröder for the argument.)

"test" on the content of the common ground. In case that there is at least one possibility where the formula ϕ holds, the test succeeds. If the test is successful, semantically speaking, nothing happens (I will argue below that there is a pragmatic effect, however). If, however, there is no possibility in which the formula holds, the test fails and the update results in an 'empty state'. An empty state is an information state in which all possibilities have been eliminated and it is, therefore, *defective* in the same way in which a state is defective after an update with a contradiction. The intuition behind this interpretation is that if a speaker says *'It might be the case that the Earth is flat'*, she is stating something contradictory in an information state where the proposition 'the Earth is flat' is known to be false.

Definition 4. [Common Ground and Information States]
The common ground, σ_{CG} is a context representing the shared beliefs of the speaker and the addressee in the discourse. σ_S is the speaker's information state and σ_A is the addressee's information state.

Like in Steedman's proposal, the common ground is understood here only from the perspective of one conversational agent. It contains both what the agent believes, as well as (what she thinks are) the addressee's public beliefs.

Definition 5. [Discourse and Updates]
A discourse Δ is a sequence of formulas $\phi_1,\ldots,\phi_n \in L_?$ where with each formula ϕ_i we associate a state of the common ground σ^i_{CG}, a state of speaker's belief state σ^i_S and a state of the addressee's belief state σ^i_A, such that $\forall i : dom(\sigma^i_S) \subseteq dom(\sigma^i_{CG})$ and $dom(\sigma^i_A) \subseteq dom(\sigma^i_{CG})$ and $\sigma^i_{CG}[\phi_i]{=}\sigma^{i+1}_{CG}$, $\sigma^i_S[\phi_i]{=}\sigma^{i+1}_S$ and $\sigma^i_A[\phi_i]{=}\sigma^{i+1}_A$. We write $\phi_1 \prec \phi_2$ for ϕ_1 precedes ϕ_2 in Δ.

With respect to answers, the intuition is that the question $?\phi$ has ϕ and $\neg\phi$ as its possible answers (same for $?\neg\phi$), whereas the question $?\diamond\phi$ allows not only for ϕ and $\neg\phi$, but also for $\diamond\phi$ and $\diamond\neg\phi$. This effect does not come out straightforwardly with partition semantics of questions (as in [Groenendijk and Stokhof, 1996] because, e.g., $?\diamond\phi$ does not introduce a partition based on its 'yes' and 'no' answers because elements of a partition cannot be empty. Therefore, the set of possible answers to a question is stipulated by the definition below:

Definition 6. [Answerhood]
The set of propositions that can be uttered as answers to the question $?\phi$, $\phi \in L$ contains only ϕ and $\neg\phi$. The set of propositions that can be uttered as answers to the question $?\diamond\phi$ contains only ϕ, $\neg\phi$, $\diamond\phi$ and $\diamond\neg\phi$.

Given this definition, the question *is Sarkozy a clever man* (with falling intonation) would have in its set of possible answers only (37-a) and (37-b), while the question *is Sarkozy a clever man*↑ (with rising intonation) would have all (37-a), (37-b), (37-c) and (37-d) as its possible answers.[9]

(37) a. *Yes. (Sarkozy is a clever man).*
b. *No. (Sarkozy is not a clever man).*
c. *Maybe. (Sarkozy might be a clever man).*
d. *Probably not. (Sarkozy is probably not a clever man.)*

Based on Grice's principles of rational conversation, I define four maxims which will restrict the number of eligible discourses, namely Quality, Relation, Quantity (1) and Quantity (2). Note that one of the goals of the analysis is to explain why both $\diamond$ statements and $\diamond$ questions are nonredundant. Existing formulations of redundant conversation moves (e.g., [Groenendijk, 1999]) assume that a statement is redundant if updating with it does not change the content of the common ground. Similarly, a question would be redundant if an answer to it would already be known, which technically translates into 'not disconnecting any possible worlds' or 'not creating a (non-empty) partition' of the common ground. Under this view, both $\diamond$ statements and $\diamond$ questions come out as being redundant, which is an undesirable effect. Therefore, a slightly different definition of redundant conversation moves is formulated in Quantity (2).[10]

Definition 7. [Maxims of Conversation]

- **Quality:** A discourse Δ conforms to Quality iff for every statement $\phi_i \in \Delta$, $\sigma^i_S[\phi_i] = \sigma^i_S$.
- **Relation:** A discourse Δ conforms to Relation iff for every statement $\phi_i \in \Delta$, ϕ_i is an answer to the most recent unresolved question. $?\phi_i$ is unresolved in σ^i_{CG} iff $\exists w, w'$ such that $w \in dom(\sigma^i_{CG})$ and $w' \in dom(\sigma^i_{CG})$ and $(w, w') \notin \sigma^0[?\phi_i]$.
- **Quantity (1):** A discourse Δ conforms to Quantity (1) iff for every statement $\phi_i \in \Delta$, there is no stronger statement satisfying the maxims given σ^i_S, speaker's knowledge at that point in the conversation. ϕ is stronger than ψ iff $dom(\sigma^0[\phi]) \subseteq dom(\sigma^0[\psi])$.
- **Quantity (2):** A discourse Δ conforms to Quantity (2) iff for every $\phi_i \in \Delta$, ϕ_i is not redundant in σ^i_{CG}. A question $?\phi_i$ is redundant with respect to σ^i_{CG} if all its answers are redundant

[9] To be precise, given the analysis of rises here, it can also receive (37-a) and (37-b) with rising intonation as an answer.

[10] In all the definitions, it is understood that the expression "a statement ϕ" stands for "a statement ϕ, s.t. $\phi \in L_\diamond$" and the expression "a question $?\phi$ stands for "a question $?\phi$, s.t. $?\phi \in L_?$.

> in σ^i_{CG}. A statement ϕ_i is redundant with respect to σ^i_{CG} iff with respect to $\phi_i^{SUB} \in L$, ϕ_i^{SUB} being the largest propositional subformula of ϕ_i, $\sigma^i_S[\neg\phi_i^{SUB}]{=}\sigma^i_{CG}[\neg\phi_i^{SUB}]$.

The maxim of Quality is formalized in terms of speaker's state. The speaker can only utter a statement that at that point in the conversation does not result in any change of her information state updated with it. This is obviously not the case if the speaker utters something she does not believe to be true – then an update of σ^i_S would give a contradiction and hence an empty state. Similarly, she cannot make a stronger statement than what she believes because then an update with that statement would change the content of her information state. For example, if she thinks that it is both possible that 'it is raining outside' and that 'it is not raining outside' because she is sitting in a window-less office, she cannot claim *'it is raining'* (or, the opposite). An update with such a statement would namely restrict the domain of her information set only to possibilities in which it is raining.

As for the maxim of Relation, it is here defined only with respect to statements; the relevance of questions is not addressed explicitly because it is a complex research topic (see, e.g., [van Rooy, 2003b], [van Rooy, 2001] for discussion). I will simply take it for granted that speakers only raise questions that somehow pertain to their conversational goals and in their proper order. As for statements, they are relevant only if they are semantic answers to questions that have not been resolved yet in the common ground, in other words, statements are relevant only if they are not already publicly known to be true.

Quantity (1) formalizes the requirement that speakers should be as informative as they can (given the other maxims). For example, if the speaker knows that 'it is raining' is true, stating *'it might be raining'* would violate Quantity (1), because updating the state of complete ignorance, σ^0, with 'it is raining' restricts the state's domain more than an update with 'it might be raining' (which actually does not change the state of complete ignorance at all - at least, semantically speaking).

By Quantity (2), questions like $?\diamond\phi$ are only redundant if it is already known whether ϕ or $\neg\phi$. A statement $\diamond\phi$ is not redundant iff the speaker's information state updated with $\neg\phi$, would be a proper subset of the common ground updated with $\neg\phi$, i.e., $\sigma^i_S[\neg\phi] \subset \sigma^i_{CG}[\neg\phi]$. This will be the case if there are less $\neg\phi$ possibilities in σ^i_S then in σ^i_{CG}, i.e., if the speaker believes $\neg\phi$ to be "less likely".[11]

To see how the proposed theory works in practice, in the next section, I return to the observations from section 5.2 of this chapter.

[11]The assumption is that all worlds in an information state have the same probability.

5.4.1 Discussion

It is easy to express the observation that inverted *yes/no*-interrogatives can sometimes appear with a rise. If they do, we represent them as $?\diamond\phi$ and correctly predict that they will be perceived as more polite (but possibly also more hesitant) than the falling $?\phi$: they allow for the weak answers $\diamond\phi$ and $\diamond\neg\phi$, while their falling counterparts require a stronger commitment from the addressee.

Similarly, a rise on a declarative, $\diamond\phi$, is interpreted as a weaker type of statement than a falling declarative ϕ. Using it does not result directly in any commitment (either from the speaker or from the addressee), because an update with a test does not eliminate possibilities from the domain of the common ground. However, by Quantity (2), the addressee can derive that there is at least one possibility in the common ground in which $\neg\phi$ holds and in which the speaker does not believe; in that sense, the statement is not redundant. In a common ground in which there is only *one* $\neg\phi$ possibility, uttering $\diamond\phi$ will effectively result in an update with ϕ. This way, one can account for cases in which uttering a rising declarative results in a commitment by the speaker (but see below for the discussion of a knowledge operator). As for ↑declaratives uttered after the addressee has committed herself publicly to the truth of the simple declarative, as in the case of echo utterances, the present setup predicts that using a rising declarative $\diamond\phi$ directly after ϕ has been uttered by the other participant is redundant. The fact that the speaker uses it nevertheless suggests that for some reason, the update of the common ground with ϕ was not successful and/or the common ground has to be revised. This corresponds to the intuition that echo utterances involve disagreement between the participants and can be interpreted as requests for additional information or at least confirmation. Accounting for this process exactly, however, requires a more fine-grained machinery than the one proposed in the present chapter.

In general, I assume that uttering a possibility statement, i.e., a $\diamond$-statement, accommodates a question to which it is the syntactic answer, i.e., $?\diamond p$, which has $\diamond p$, $\diamond\neg p$, p and $\neg p$ among its answers. In a rational conversation, participants cooperate on finding the strongest possible answers to questions that have been raised (whether overtly or accommodated). Therefore, if a $?\diamond p$ question has been raised and there is a participant who knows that either p or $\neg p$ is the case, she will say so (otherwise, she would not be cooperative). Thus, a rising declarative (a $\diamond$-type of statement), will frequently be followed by an evaluative response. Crucially, this response is not an answer to the rising declarative but addresses the question accommodated *due to the use of* the rising declarative.

The analysis can easily model the fact that rising declaratives are not interchangeable with the corresponding polar interrogatives: after all they are assertions, which express a bias also in contexts in which the ratio of worlds making them true and worlds making them false should remain 1:1. For example, used as an exam question, a rising declarative *the empty set is a subset of itself*↑ would

swing the odds of the proposition 'the empty set is a subset of itself' being true for its favor in a common ground which is supposed to be absolutely neutral.

Similarly to rising *yes/no*-interrogatives, also rising declaratives come out as being more polite than their falling counterparts. If the speaker updates the common ground with a falling declarative ϕ and the addressee believes $\neg\phi$ to be true, the participants are in an open disagreement and a correction of the common ground may be needed. If, on the other hand, the speaker uses a rising declarative $\diamond\phi$, she generally does not eliminate all $\diamond\neg\phi$ worlds (unless there is only one) and the addressee can still utter the stronger statement $\neg\phi$, if she believes it to be true, without overtly disagreeing.

The proposal does not predict any link between final rises and continuations, which appears to be justified, given the results of the empirical study reported in chapter 3. Also, the meaning of the rise is here treated on the same level as the meaning of the words and phrases in the utterance. In that sense, intonation is actually "stronger" than the lexical-pragmatic features (e.g., the presence of a hetero-cognitive predicate) examined as possible indicators of evaluative-response seeking utterances in chapter 3, since their possible effect is very indirect.

The account of $\uparrow$ as an expression of epistemic uncertainty is compatible with the results reported in chapter 4. There, it was observed that listeners tend to interpret rising interrogatives as questions with respect to which the speaker expects/hopes for an affirmative answer, while falling interrogatives did not receive this interpretation (they were interpreted as without bias or with a negative bias). Under the present formalization, the use of a falling interrogative $?\phi$ allows only for two – strong – answers (an understanding which is confirmed by the observation of [Bartels and Merin, 1998]:98, who note that a falling interrogative is "akin to an alternative question in saliently evoking two mutually exclusive alternatives: the surface proposition and [...] its negation"). With the use of a rising interrogative, on the other hand, the speaker signals to the addressee that she would be satisfied also with a weak answer ($\diamond\phi$ or $\diamond\neg\phi$). This could be for reasons of politeness but also because the speaker wishes for the affirmative answer (desired-state bias) and even $\diamond\phi$ would, by inference, bring her closer to that goal. The account also allows for those cases (problematic for the decision-theoretic approach discussed in the previous chapter) where the speaker uses a (positive) polar interrogative with informational bias towards the affirmative answer. In such cases, the answer $\diamond\phi$ would be as informative as the strong answer ϕ to $?\diamond\phi$ in case there is only one $\neg\phi$-possibility left in the common ground. In such a situation, the $\neg\phi$ possibility would be eliminated by both ϕ (directly) and $\diamond\phi$ (by pragmatic inference via the maxim of Quantity (2)).

In the beginning of this chapter, the final rise was claimed to be a kind of intonational adverb. Note, however, that it is not exactly synonymous with a particular lexical adverb and all the translations of the final rise with a lexical expression should be understood very loosely. The syntactic and semantic behavior of lexical adverbial expressions and corresponding adjectival phrases is rather

complicated (viz, a.o., [Cinque, 1999], [Nilsen, 2003]): for example, the adverb *possibly* appears to be excluded from some (but not all) interrogatives, while its adjectival counterpart *it is possible that* is not. Also, it is generally assumed that there is a syntactic and presumably also semantic difference between *it might be that, maybe, possibly* or *perhaps*. In principle, I do not exclude the option of formalizing the meaning of one of these operators with Veltman's test diamond, but at least *'maybe'* seems to function differently from the rise, as show by the following dialogue:

(38) a. A: *I lost my ring*
b. B: *did you leave it in the bathroom?*
c. B': *maybe you left it in the bathroom*
d. B": *you left it in the bathroom*↑

The reply (38-d) patterns with the reply in (38-b) in that a response by speaker A is expected. The relevant difference seems to be that in (38-b) and (38-d), but not necessarily in (38-c), the speaker A is assumed to be knowledgeable with respect to the content of the utterance. This example cannot be handled by the formalization proposed here, because it lacks the machinery to express propositions of the type 'A knows that...'.[12] For that, it would be necessary to add accessibility relations for the communicating agents, expressing, e.g., that while A knows that ϕ is true, B does not. That way, it would also be possible to model the effect of utterances like *'I don't know* on the common ground. Presumably, one could also address the fact that not only rising declaratives, but also falling declaratives are often responded to by the addressee if they concern an issue on which she is an expert.

5.5 Conclusion

In this chapter, the meaning of the final rise, abbreviated as ↑ and understood to refer to any of the H*H-H%, L*L-H% and L*L-H% tunes expressed in broad ToBi, was discussed for American English. First, the available empirical findings with respect to the use and interpretation of the tunes were summarized. The observations made were summarized in twelve points, repeated here below:

1. ↑ is possible but not necessary on polar interrogatives.
2. ↑ is possible on declaratives.
3. Some ↑declaratives commit neither the speaker, nor the addressee to their truth.
4. Some ↑declaratives commit the speaker to their truth.

[12] Thanks to David Ahn for bringing this example to my attention.

5. Some ↑declaratives are only used if the addressee is already committed.
6. ↑declaratives are evaluative response-seeking.
7. ↑declaratives are not interchangeable with polar interrogatives.
8. ↑utterances are considered to be more polite and friendly.
9. The paralinguistic interpretation of the ↑ is 'uncertainty'.
10. ↑ is not associated with continuation.
11. The meaning of ↑ is "strong".
12. ↑ polar interrogatives are associated with desired-state bias (expectations of an affirmative answer).

The overview was subsequently used to evaluate selected semantic proposals regarding the meaning of rising intonation in English. It was observed that in the proposal of [Pierrehumbert and Hirschberg, 1990], the L* should be associated only with old information, which does not appear to be the case for some corpus examples. Also, the observations (3), (4), (5), (7), (8), (9) and (10) cannot be easily accounted for in the system. In the approach of Merin & Bartels ([Merin and Bartels, 1997], [Bartels and Merin, 1998]), on the other hand, most of these observations directly followed from the meaning ascribed to phrase and boundary tones (disregarding the observations (10), (11) and (12) which are not explicitly treated), using the 'dominance' parameter in a bargaining game. The meaning of tunes like L*L-H%, however, remained unspecified, for some examples (e.g., (28-c)), other than the perceived meaning was predicted, and the model could not accommodate the observation (3) above. In the proposal of [Gunlogson, 2001], the usage of ↑declaratives in contexts where the addressee is not already committed or becomes committed is problematic. Also, the approach does not offer a plausible explanation as to why rising declaratives in all of these cases tend to elicit a response from the addressee. The system of [Steedman, 2004a] predicts that a proposition necessarily commits either the speaker or the hearer, which is problematic, given the observation (3). Also, counterexamples can be found both to the claim that a high boundary tone signals addressee's commitment and a low boundary tone speaker's commitment. Similarly to Gunlogson's description, there is no obvious explanation for observations (8) and (9) and, in fact, Steedman assumes that the meaning of high boundary tones expressed in terms of speaker's commitment is related to continuations, a claim which does not appear to hold at least for the ↑-rises and one particular interpretation of continuation examined in chapter 3.

The reviewed approaches provided important clues for the formalization in terms of update semantics proposed in this chapter. Like in the work cited above,

the meaning of ↑ was here taken to express propositional attitudes, i.e., to reflect the status of propositions in the set of mutual beliefs in the conversation. More specifically, I adopted the idea that rising declaratives do not necessarily commit the speaker to their content, but rather than engraving this property into their proper meaning, pragmatic mechanisms were used to explain it instead. The ↑ was formally represented as a modal expression of epistemic uncertainty, a kind of intonational adverb, comparable to the expression *'it might be that'*. The linguistic contribution of rising intonation was thus directly linked to its paralinguistic effect, which was described as 'uncertainty', 'submissiveness', etc. (viz. the discussion of the *Frequency Code* in chapter 2). A rising declarative was interpreted as a weak assertion, which in the update semantic model utilized here functions as a test on the content of the common ground, but does not change it.[13] A rising interrogative, in turn, is a question that allows for a weak assertion as an answer.[14] From a pragmatic point of view, the use of the rising utterances is non-redundant because of Grice's maxim of Quantity (2). Thanks to this maxim (at least under the formalization offered here), the addressee can infer that a weak assertion implies a difference between speaker's beliefs and the content of the common ground with respect to its polar alternative. The fact that weak assertions often receive an evaluative reply from the addressee was also derived pragmatically. It was assumed that every assertion is an answer to a question, even if that question was not explicitly raised in the course of the conversation. By virtue of being cooperative, the conversational participants address the question under discussion to their best abilities. As a consequence, if the addressee of a weak assertion can provide a stronger answer to the question the assertion addresses, she will do so. In other words, the frequently observed sequence '↑ ϕ' – 'ϕ' (e.g., *'it's raining*↑' – *'yeah'*) in dialogues was interpreted as a sequence of two answers to the question ? ↑ ϕ (raised by the interrogative *'is it raining?*↑'), a weak one (↑ ϕ = '$\diamond\phi$') and a "strong" one ('ϕ'). It is possible that speakers exploit the sequence in conversations in order to elicit answers to implicitly raised questions, especially if they regard the addressee as an expert on an issue, i.e., as being able to provide the strong answer. Yet the relation between rises and the evaluative response-seeking function remains indirect in the sense that it is not a part of the semantics of the rise but its pragmatic effect derivable from the maxims of rational conversation.

[13]The update with $\diamond\phi$ is usually non-deterministic but the function can be turned into a deterministic one if we use sets of sets of possibilities (cmp. [Beaver, 1995]:9.3).

[14]Note that given the view advocated here, natural language is misleading in that we talk about 'rising declaratives/interrogatives, as if the rising intonation was modifying full sentences. I argued, though, that the rise is interpreted as an adverbial-like operator, which scopes over a syntactic phrase prior to the interpretation of the complete sentence.

Chapter 6

French Rises in Dialogue

6.1 Introduction

In the previous chapters, we have seen the use of final rises in American English and I have proposed to interpret their linguistic meaning as a marker of epistemic uncertainty. This interpretation is directly linked to what is assumed to be primarily their paralinguistic effect by [Gussenhoven, 2004] and others, as expressed by the *Frequency Code*, discussed in chapter 2 and repeated below:

> **The Frequency Code.** Smaller larynxes contain lighter and smaller vocal cords, with which faster vibration rates are achieved for a given amount of energy. The correlation between larynx size and rate of vocal cord vibration is exploited for the expression of power relations across species: lower pitch is associated with larger body size and hence with social dominance ([Ohala, 1983], [Ohala, 1984]).

As already noted, the *Frequency Code*, especially with respect to its paralinguistic overtones, is understood to be universal. If so, it is legitimate to compare the use of rises in American English with other languages.

In this chapter, I will discuss final rises in dialogues in Standard French. Its comparison to English is facilitated by the fact that in many respects, the two languages are similar – both are Indo-European languages and historically, English has been greatly influenced by French. On the other hand, Romance languages have been claimed to differ from Germanic languages prosodically, e.g., with respect to issues such as stress-timed versus syllable-timed or the relative likelihood of deaccentuation being higher in Germanic. After a general introduction based on the existing literature, I will report the results of two studies – a pilot study of a Map Task corpus with two speakers and a subsequent study of a sample from the Caelen corpus – in which we searched for connections between final rises and

dialogue acts (moves).[1] The results have to be interpreted as preliminary given that notions like 'discourse topic', '(types of) dialogue acts', 'intonational phrase boundary' or 'utterance boundary' are difficult to define in a reliable way (i.e., theoretically uncontroversial and giving high inter-rater agreement). Also, the employed approach was not a replication of the study of American English because the ToBI alphabet – though proposed ([Jun and Fougeron, 1995], [Post, 2000]) – has not been tested on larger samples for French. Nevertheless, some tendencies can be reported which might serve as a basis for further explorations.

An initial study indicated that final rises in French are more strongly associated with topic introduction than with questions, suggesting that a biological code other than the *Frequency Code* is at play. The results of the subsequent Caelen study confirmed that there is a weak correlation between questions and rises, and a stronger link between topic openings and rises; however, the two effects appear to be independent of each other, despite the fact that questions frequently serve as topic openers. A possible explanation would be that two different kinds of rises have to be distinguished (a distinction which cannot be captured solely with the INTSINT alphabet) – one associated with the *Frequency Code* and the other associated with the *Production Code*, which had been linked to topic openings because it reflects the newness of a constituent (in this case, of an utterance in discourse).

> **The Production Code.** The generation of energy is tied to the exhalation phase of the breathing process, and hence becomes available in phases. As a consequence, high pitch is associated with the beginnings of utterances, while low pitch is associated with the ends.

6.2 Rises and questions in French

According to most French speakers, it is possible to turn an assertion into a question in French solely by pronouncing it with a rising intonation, cf. (1), (2). The use of rising declaratives as questions has been described by [Delattre, 1966] in his classical article and in a number of other studies of French intonation (a.o., [Martinet, 1960]) as well. According to [Terry, 1967], questions with the declarative form (without inversion or *est-ce que*) are by far the most frequent polar questions (about 85% in his corpus), cmp. also [Hansen, 2001]. This observation was confirmed by [Grundstrom, 1973], who also noted that rising intonation is not excluded in questions with *est-ce que*.

(1) *Vous ne dites rien*↓ (final fall, assertion)
"You say nothing."

[1] The studies were performed in 2004-2005 at IRIT, University of Paul Sabatier, Toulouse. They are the product of joint work with Philippe Muller and Laurent Prévot. Their permission to reproduce the results here is gratefully acknowledged.

(2) *Vous ne dites rien*↑ (final rise, question)
"You say nothing?"

With respect to rising intonation as such, [Grundstrom, 1973] confirms that in his corpus, questions were prevalently rendered with a rising intonation, though there were certainly also non-questions with a rising contour and questions with falls. He also notes that the most apparent factors that could influence the question contour were the presence of *est-ce que*, the presence of an interrogative tag, speaker's hesitation, and an emphasis on a non-final syllable. In a subsequent perceptual study, Grundstrom found that speakers tend to associate rising intonation with questions but utterances with final falls can also be perceived as questioning, especially if there is an intonational emphasis earlier on in the utterance. Contrary to Grundstrom's results, [Fónagy and Bérard, 1973] in their corpus found that more than 40% of polar questions did not occur with a rising intonation (their definition of a question was, however, rather broad, see below); among these were also sentences which were otherwise not marked for interrogativity and their intonation resembled that of declaratives. In a subsequent perceptual study, though, falling declarative questions were generally not classified as questions by the judges, thus confirming Grundstrom's results.[2]

In sum, while existing empirical studies confirm that there is some correlation between rising and falling contours, and questions and assertions, respectively, they also show that – comparably to the situation in American English – rising intonation does not always go hand in hand with question intonation (see also [Hansen, 2001] and [Beyssade and Marandin, 2004, Marandin et al., 2004], a.o., for the same conclusion).

Nevertheless, it has been argued that the generalization that final rise indicates "questionhood" may be maintained for French if we assume that intonation can sometimes go against the morphosyntactic form of an utterance. Its meaning – a combination of the prosodic and morphosyntactic information – would then be a result of an interpretational conflict: the speaker would both be asserting and *not* asserting a proposition. This line of reasoning is taken by [Marandin et al., 2004] who suggest that rising declaratives can operate a double update: While they can have the same effect on the common ground as assertions, the non-falling contour

[2]With respect to other prosodic factors, [Grundstrom, 1973] notes that the length of the final vowel contributes to question recognition (non-questions have much longer vowels than questions). He also found that intensity had no influence on question recognition. Both Post [Post, 2000] and [Martin, 1982] assume that in French, intensity and duration do not significantly influence intonation patterns which are primarily due to variations in the pitch curve. With respect to $F0$, the bigger the rise, the higher the likelihood that subjects classified an utterance as a question. [Maury, 1979] and [Wunderli, 1988] (as cited by [Léon, 2001]) argue that the *débit accéléré* plays a role as a question marker. [Fónagy and Bérard, 1973] note that the average $F0$ of assertions is slightly lower than that of questions (206.5 Hz as opposed to 239.5 Hz for questions) and the average size of the fall is larger (6.7 semitones as oppossed to 5.7 semitones for questions).

also suggests that the speaker anticipates a revision of her beliefs ("what the speaker knows/believes about a given issue is not, or may be not, compatible with what the speaker assumes the addressee knows/believes about the same issue", [Marandin et al., 2004]) and expects feedback from the addressee. According to the authors, this is why rising declaratives often have the same effect as questions and/or are used to keep contact with the addresee. The proposal also has the potential to explain why rising declaratives usually receive a response from the addressee as if they were questions: the addressee interprets the rising intonation as a signal either to give an explicit acknowledgement or to explain why it cannot be given, as in the example in (3-b) from [Marandin et al., 2004]:

(3) [Context: A grandmother to her grandson after school.]
   a. *J'ai téléphoné pis t'étais pas encore rentré.*
      "I called but you weren't home yet."
   b. *T'as été à la flûte* ↑
      "You were at your flute lesson?"

A counterexample to the proposal outlined above is that there appear to be rising declaratives that are neither interpretable as assertions, nor as anticipating a revision. For example in the sequence in (4), (4-b) cannot be followed by (4-c) (unlike the true assertion in (4-a)) and it is also difficult to maintain that the speaker B in (4-b) expects the speaker A to disagree with her.

(4) a. A: *Il peut le faire.*
      "He can do it."
   b. B: *Ah, il peut le faire?*
      "Ah, he can do it?"
   c. A: # *Tu te trompes./ Je ne suis pas d'accord avec toi.*
      "You're wrong./I don't agree with you."

The precise nature of the rise in (3-b) or (4-b) is difficult to capture given that little is known about the use of final rises in French in general. Clearly, an answer cannot be given without a proper empirical study of the use of rises in natural conversational speech. Initially, we performed a pilot study on Post's Map Task corpus ([Šafářová et al., 2005]) with two speakers and two dialogues (for a total of 301 speech turns); its primary goal was to test the chosen methodology, especially with respect to intonation transcription, segmentation and discourse segment classification, and to identify the most prominent uses of final rises. In the subsequent study of the Caelen corpus ([Bessac and Caelen-Haumont, 1995]), for a total of 264 utterances, we focused on the relation between questions, topic openings and final rises. In the following sections of this chapter, I will first discuss some basic theoretical issues relevant for the corpus analysis, in particular the choice of the intonational transcription system and a scheme for describing dialogue units. I will then present the results of the pilot study, followed by the

results of the Caelen corpus study, which contained a broader sample of speakers. Some research directions are briefly suggested in the final section.

6.3 Methodological issues

6.3.1 The transcription of Intonation

As noted by [Post, 2000], there exists no consensus in French intonation studies about which changes in contours are categorical and whether one should take contours as holistic units or as a composition of individual tones, anchored on stressed syllables and intonation unit boundaries. Also with respect to rising intonation, a number of proposals can be found in the literature. For example, [Delattre, 1966] distinguishes between four types of rises, *Question, Continuation majeure, Continuation mineure* and *Implication* (strictly speaking, the last one occurs with a small final fall, which, however, does not reach speaker's mid register). [Grundstrom, 1973], on the other hand, describes two kinds of rises he observed on the final vowel (which he took to be the most significant location of melodic variation), a *courbe ascendante* - a rise in frequency which could be finished by a brief horizontal movement ; and a *courbe haute-statique* - a high frequency at a constant niveau, higher than on the penultimate syllable.

In our study, we have made use of the INTSINT (INternational Transcription System for INTonation) annotation system, already described in chapter 2. The advantage of the MOMEL-based INTSINT annotation is that it can be done automatically (e.g., in PRAAT with one of the publicly available scripts) and is thus faster and more consistent than an annotation done by human annotators which is an issue of relevance in a large(er) corpus study. Similarly to MAE-ToBI for American English, the MOMEL-based INTSINT annotation is the most common procedure for describing intonation in French; the MOMEL algorithm has been repeatedly tested and the assumption is that the stylized curve captures all perceptively prominent $F0$ properties of the signal.

As already noted, the labels utilized by INTSINT include absolute prosodic events (**T** - Top; **M** - Mid; **B** - Bottom) and relative ones (**H** - Higher; **S** - Same; **L** - Lower; **U** - Upstep; and **D** - down). We considered all instances of **T**op, **H**igher and **U**pstep to be potential rises. This choice may appear to be questionable for the case of **U**pstep, which according to the original description of the alphabet should be associated with less prominent movements than **T**op and **H**igher. In practice, however, it was found that the occurrences of **U**pstep were difficult to distinguish from **H**igher, both perceptually and by visual inspection of the pitch track.

Prior to the automatic annotation, the utterances extracted from the corpus were segmented into individual sound files, with boundaries based on speaker-

switch points[3] and longer pauses (which, especially if segment-initial, are known to pose problems to the MOMEL algorithm). For the Map Task corpus, the segmentation was sometimes problematic due to speech overlaps. Overlapping utterances were mostly left out in the subsequent evaluation because the intonational description was judged unreliable. The CAELEN corpus contains individual recordings for each speaker, which allowed for a clean extraction of all the randomly chosen segments. The automatic annotation was validated for all the selected segments in the sample, using the original sound recording for a perceptual validation, together with the PRAAT $F0$ extraction algorithm (based on the auto-correlation method) for a visual inspection of the curve. For the purposes of our study, only $F0$ events (labeled with the INTSINT alphabet) aligned with the boundaries of relevant prosodic segments were taken into consideration. In the following section, some definitions of prosodic boundaries and their detection will be examined.

6.3.2 Prosodic boundaries

The most frequent interpretation of the term 'final rise' is that it is a rise aligned with a right-edge sentence or utterance boundary. In conversational speech, however, sentential/utterance boundaries are notoriously difficult to detect. Also, according to some authors (e.g., [Beyssade et al., 2004]), all boundary tones associated with right edges of intonational phrases (IPs) are assumed to be meaningful. For this reason, we initially decided to take intonational phrases as the relevant segments in the Map Task corpus (in the Caelen corpus, we only analyzed segments larger than IPs, viz. below).

As noted in the literature, even non-expert listeners have the ability to perceive prosodic boundaries ([de Pijper and Sanderman, 1995]) but the fact remains that in a natural conversation, boundaries are difficult to annotate and also to distinguish. From a prosodic perspective, intonational phrases in French have been claimed to associate (optionally) with acoustically and perceptually identifiable events of both rhytmical and tonal nature, such as pauses, drops in amplitude, final syllable lengthening, pitch resetting (on the first syllable of the subsequent phrase), and lack of some segmental assimilation processes (viz., a.o., [Jun and Fougeron, 2002], [Post, 2000] or [Féry, 2006]). IP boundaries have, however, also been assumed to correlate with the topic-focus articulation; in fact, [Beyssade et al., 2004] define them only as a reflection of information structuring. Furthermore, it is normally assumed that there is some correlation between prosodic phrasing and syntactic boundaries (although, as already noted, this assumption has been repeatedly questioned).[4] Taking all these claims into consider-

[3]The natural cut-off point may seem to be the end of a turn, but in spontaneous dialogues, it is often difficult to determine turn endings exactly, given the frequent overlaps and barging in. A speaker switch point is simply the place where another speaker starts speaking.

[4]At least according to [Ladd, 1996] these often tend to complicate rather than facilitate the

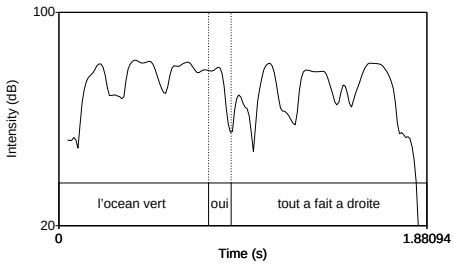


Figure 6.1: A parenthetical *'oui'*.

ation, prior to the annotation process, the following rules were proposed to serve as a guidance to the annotators in IP boundary detection:

1. Every completed turn boundary is a right edge IP boundary.

2. Phonologically, an IP boundary is often (i) indicated by a pause, (ii) accompanied by syllable lengthening of the preceding syllable, (iii) followed by pitch resetting and (iv) accompanied by a drop in amplitude.

3. An IP boundary often coincides with a major syntactic boundary (e.g., a finite clause boundary).

4. An information structure constituent (topic, focus) can be followed by an IP boundary.

The Map Task corpus was annotated for IP-boundaries by three annotators (two native speakers of French, one non-native). For an indication of the inter-rater agreement, the results were evaluated using the *kappa*-statistics with the average kappa for the three annotators being .718 (i.e., 'good' on the Landis-Koch scale). Evaluation of problematic examples showed that short phrases like "*oui*" were a frequent source of disagreement. It also did not appear to be possible to formulate a general rule on their segmentation, since in some cases, *oui* is clearly parenthetical, identifiable by lower intensity than the rest of the unit (as in 6.1), and should be treated as a separate IP, while in other cases it arguably forms a part of an IP with the following material.

Short phrases such as "*bon*", as in "*Bon, d'accord*", particles and adverbial phrases like "*alors*", "*donc*" or "*par contre*" and the utterance final "*quoi*" raised a similar problem. The annotators also disagreed at hesitation points (often filled with "*euh*") and with respect to interruptions and self-corrections (also found to be problematic in MAE-ToBI (viz. [Beckman and Ayers, 1997]), as well as events

task by providing incompatible rules. As [Ladd, 1996]:235 puts it, "IPs are supposed to be set off by audible boundaries: if IP boundaries were not audible, then much of the point of [their function] would be lost."

which normally imply an intonational phrase boundary, such as pauses and vowel lengthening. Given that in case of disagreement, it was usually difficult to decide for or against a label, all the intonational phrase boundaries proposed by the three annotators were merged together in the final annotation. This may have lead to the inclusion of segments smaller than IP (in particular, accentual phrases, viz. [Jun and Fougeron, 2002]) into the data, since one of the three annotators did not appear to distinguish among the two levels of phrasing.[5]

Apart from being based on subjective judgment regarding intonational phrasing and information structuring, the manual annotation of IP boundaries was evaluated as highly time-consuming and, consequently, the option of using a semi-automatic method of boundary assignment was considered. A method based on automatic pause detection (with minimal length of 15 ms and maximal intensity of 40 dB) and a manual assignment of boundaries to all points of speaker switch was tested on the corpus. The semi-automatic method gave approximately 2/3 and 3/4 of the manually assigned intonational phrase boundaries for the two Map-Task dialogues, respectively. Only in a small number of cases, the pause did not coincide with the original IP label, mostly due to long pre-plosive silences.[6] The optimal pause length, however, turned out to be clearly speaker-dependent and, in that sense, the choice of its length somewhat arbitrary. Therefore, in the Caelen corpus study, only rises at points of speaker switch and preceding longer pauses (100 ms and more) were analyzed as prosodic segments relevant for the discourse use of final rises.

6.3.3 Defining Dialogue Acts

In the pilot study, the Map Task corpus was annotated for types of dialogue acts, based on an existing annotation scheme for route description dialogues in which each dialogue act is assigned a mode and a function ([Prévot, 2004], reproduced below).[7] To avoid bias, the annotation was done solely on the transcript of the dialogues from which the original punctuation signs were removed. The task of dialogue act segmenting and labeling was done by the three authors independently. The final annotation was based on both the majority opinion and a subsequent discussion which served to clarify the intuitions behind the taxonomy.

[5] An alternative would have been to consider only those IP boundaries where all annotators agreed, or to assign *strength* to them according to how many of the annotators agreed on a boundary being present.

[6] Many pre-plosive silences were longer than meaningful pauses, even exceeding 350 ms (see [Campione and Véronis, 2001] for a similar observation).

[7] For more information about other systems like DAMSL, see [Jurafsky et al., 1997] and [Prévot, 2004].

- **MODES:**

TAG	DESCRIPTION	PROPERTIES
qyn	*question oui/non*	viz. the discussion in the text
qwh	*question à pronom*	overt or elided *wh*-pronoun
qal	*question alternative*	two PQs connected with *'ou'*
imp	*impératif*	imperative syntax
ass	*assertive*	indicative syntax, fails PQ def
fxd	*faux départ, hésitation*	an incomplete utterance
ind	*indéterminé*	utterance w/ unclear mode

- **FUNCTIONS:**

ir	*introduction de référent*: first time a landmark mentioned
dr	*description de référent*: description of landmark
par	*prescription avec repère*: a motion predicate, mostly in 2.p.sg, with a PP
psr	*prescription sans repère*: a motion predicate, mostly in 2.p.sg, without a PP
pre	*description de segment*: an elaboration of par/psr
loc	*localisation*: a loc phrase not governed by a motion predicate (in 2.p.sg.)
da	*demande ack*: a question or an assertion that explicitly asks for an ack
com	*commentaire*: commentary on the task, not a part of the route description
cor	*correction*: correcting a part of other speaker's utterance
qap	*reponse*: response to a question
ack	*ack*: acknowledgment
rej	*rejet*: rejecting other speaker's utterance, e.g. because existence of a landmark falsely presupposed

The most problematic (but also most relevant from an intonational point of view) was the recognition and classification of polar questions, which in Prévot's original proposal were (in retrospect, incorrectly) identified on the basis of their intonational properties. [Fónagy and Bérard, 1973] propose to treat as questions all utterances that receive a *oui/non* reply in the context. But similarly to English, also for French, this condition is both too weak and too strong. It allows for acknowledged utterances (as in (5), with I an instruction giver and K the instruction follower), to be categorized as questions, and it excludes questions that received a response which contextually entailed a *yes/no-* or *I-don't-know* answer, as in (6).

(5) a. I: *donc, euh, tu continues tout droit, avec les maisons obscures à ta droite*
"so, euh, you continue straight ahead, with the dark houses on your right"
b. K: *oui*
"yeah"

(6) a. I: *tu fais une petite boucle*
"you make a little turn"

b. K: *devant les maisons obscures?*
"before the dark houses?"
c. I: *ben enfin, tu passes devant les maisons obscures*
"well, actually, you pass before the dark houses"

An alternative solution seemed to be to use the question test employed for American English (as described in chapter 3). Since the subject - finite verb inversion in French is extremely rare, the test was adapted by using the *est-ce que* form instead. In the Map Task corpus, we thus considered all indicatives which were followed by a response entailing *yes/no/I don't know*, were turn-final and, in the context, would be felicitous if turned into *est-ce que* interrogatives to be polar questions (i.e., apart from formally marked polar interrogatives). The *est-ce que* test, however, had certain disadvantages. First of all, intuitively, it seems that *est-ce que* interrogatives carry an attitudinal overtone in the sense of appearing "unexpected" in the discourse structure (according to [Hansen, 2001], they express a stronger degree of doubt and are more emphatic than other types of interrogatives). This makes their use less preferred in contexts where the utterance is not topic-opening (viz. the following section for a discussion about topic openings). Also, for some utterances the test gave unnatural renderings (e.g., for the pair "*D'accord? - D'accord.*", the variant "*Est-ce que tu es d'accord?*" is strange at best) or unintuitive results, e.g., the utterance "*Je ne sais pas si tu le vois*" was not classified as a question, although it is clearly seeking an evaluative response from the addressee. Therefore, in the Caelen corpus study, a different method of question identification was employed, based on the observation of [Beun, 1990] for Dutch that a prominent feature of questions is speaker's partial or complete ignorance with respect to the truth of the contained proposition.

In the Caelen corpus, all non-interrogative utterances which were followed by a speaker switch, received an answer-like reply in the context and addressed an issue about which the speaker was not expected to be knowledgeable were classified as questions (together with utterances of interrogative form). For example, (7) below was classified as a question because it concerns addressee's belief state of which the speaker cannot be knowledgeable. On the other hand, (8) was not classified as a question because it concerned an issue on which the speaker herself was an expert.

(7) *vous voyez la route de Lyon?*
"you see the Lyon Street?"

(8) *moi j'aime beaucoup*
"I like it a lot"

The annotation for 'speaker knowledge' was done by one annotator for all utterances which received a reply and was subsequently consulted with two other annotators. Among the 264 extracted utterances, there were 113 utterances tagged for

presence or absence of 'speaker knowledge' (as noted above, only utterances followed by a speaker switch and receiving a response contextually entailing *yes/no/I don't know* were tagged, since only these were considered as possible questions). There were three cases of disagreement; for these utterances, the majority opinion was considered decisive. Note that the annotation for 'speaker knowledge' was facilitated by the nature of the dialogues, which involve the discussion of a tourist office agent with a tourist (mirroring the Map Task in a somewhat more natural setting). The method may give more annotator disagreement if employed for spontaneous dialogues where the expert - non-expert roles are not clearly defined.

With respect to identifying constituent questions and alternative questions, we initially expected the task to be unproblematic, given that these question types contain markers in the form of *wh*-words and the disjunction *ou*, respectively. In practice, a number of examples turned out to be debatable. For instance, it was not clear if an utterance ending with *ou* should be treated as an alternative question with an ellipsis of the second constituent, or if the connective merely serves to indicate speaker's uncertainty, as in (9), especially if the question received a *yes/no*-response.

(9) *et à beaucoup de centimètre du pic ou. . . ?*
"and several centimeters from the top or. . . "

There were also apparent instances of constituent questions with the question word missing, as in (10), where the speaker is asking where the hotel is situated on the map, given the location of the torrents and the ocean.

(10) *et alors l'hôtel par rapport aux torrents et l'océan?'*
"and so the hotel with respect to the torrents and the ocean?"

However, in the final evaluation for both corpora, the number of constituent and alternative questions was very low and their identification thus did not play a crucial role for the results of the study.

6.3.4 Dialogue structure

Apart from a connection between rises and questions, rises are also often linked to discourse topics but, as generally acknowledged, topic openings are difficult to identify in a systematic way. One possible approach is to use dialogue structure, with a hierarchy of sub-dialogues. Therefore, in the pilot study of Post's Map Task corpus, an annotation of the discourse structure and relations between discourse segments was done by a skilled annotator, with the secondary goal to look for possible correlation between discourse relations and rises. The discourse structure was partly determined on the basis of the dialogue act annotation described in the previous section. The targets of each dialogue act were systematically identified (including "backward-looking" acts, such as acknowledgment or

answer), and discourse relations (such as *Elaboration*, *Background* or *Narration*), viz. [Asher, 2004] and the literature cited there.

Topic openings were detected on the basis of the following discourse events:

- discourse pop-ups, i.e., attachments of a new constituent higher in the hierarchy than the previous utterance;
- activity changes (e.g., in the case of the Map Task, from landmark management to instruction), as in (11-d), compared to (11-a);
- introduction of new landmarks, as in (12);
- clarification and feedback requests, as in (13);
- presence of the discourse markers *donc* and *alors*, as in (14) and (15).

(11) a. I: *là, tu vois un grand abribus?*
"there, you see a big bus stop?"
b. K: *oui*
"yeah"
c. I: *oui*
"yeah"
d. I: *alors là, tu fais un virage sur toi même pour passer*
"so there, you turn around and continue"

(12) *est-ce que tu as... tu as le profond étang?*
"do you... do you have the deep lake?"

(13) *ça va? c'est bon jusqu'à maintenant?*
"is it okay? is it fine until now?"

(14) *donc euh... tu tu vois les maisons obscures?*
"so euh... you you can see the dark houses?"

(15) *alors, euh, sur la diagonale entre l'orfèvre et le petit pin*
"so, euh, on the diagonal between the goldsmith and the small pine tree"

Since the main aim of the discourse structure annotation task was to test for a possible correlation between discourse openings and rises (found in other languages, and also in the pilot study, viz. the following section for details), in the Caelen study we focused solely on this discourse property. Based on the clues above, a single annotator identified 41 topic openings in the analyzed sample; the annotation was subsequently checked by two other annotators. There were in total 9 disagreements. In the final analysis, all utterances identified as topic-opening by at least one of the authors were considered as members of the category for the purposes of the statistical analysis.

Label	Dialogue IK	Dialogue KI	Total
Intonational Phrase (IP) boundaries	281	359	640
Dialogue acts (DA)	200	224	424
Rises at IP boundaries	137	149	286
Rises at IP and DA boundaries	106	95	201

Table 6.1: *An overview of results (counts) in the pilot study.*

6.4 Results

6.4.1 The Map Task pilot study

The relation between rises at IP boundaries and types of dialog acts was judged with the help of the chi-square statistic and the Fisher exact test, with $p < .05$ Using the above described methodology of dialogue act (and, especially, question) identification, in the Post's Map Task corpus, a positive correlation was found between rises and polar questions and between rises and prescriptions using landmarks (viz. example (16)). The annotated corpus transcript is given in Appendix B.

(16) *et là, tu redescends jusqu'à gauche de l'orfèvre*
"and there, you go down all the way to the left side of the goldsmith"

On the other hand, answers to questions were more likely to appear without a rise. With respect to discourse structure, we found that rises were significantly correlated with topic openings and rise absences with topic closings (with $p <$ .01). The number of openings was higher than the number of topic closings (75 vs 52, respectively); this discrepancy was due to the fact that many topic closings are implicit and thus harder to identify systematically. The rise-opening correlation was stronger than the correlation rise-questions, suggesting that the first association was not simply due to the frequent question effect of introducing new discourse topic. Finally, speaker variation was observed, especially in the association of rises with acknowledgments (e.g. "*oui?*") which was extremely frequent in one of the speaker's output for one dialogue. Given the size of the Map Task corpus and the fact that one of the dialogues was shorter than the other,[8] it was not possible to determine whether rising acknowledgments were not linked to a specific dialogue role (in particular, instruction follower).

[8]The IK dialogue (with Isabelle as the instruction giver and Karine as the instruction follower) contained 129 turns; the KI dialogue contained 172 turns.

6.4.2 The Caelen corpus study

The association between rises and polar questions, found in the pilot study of Post's Map Task was confirmed in the study of samples from the CAELEN corpus, despite the different method for question identification. In general, slightly less than 58 % of all questions were rising ($\chi^2 = 3.126$, $p = .08$), with rises present on 45 % of the selected utterances, i.e., statistically speaking, the link between *all* questions (i.e., not just polar questions but also constituent and alternative questions) and rises was not significant. Topic openings were prevalently rising (slightly more than 56 %, $\chi^2 = 6.0521$, $p = .01$) and it was confirmed that questions are mostly topic-opening ($p < .01$). On the other hand, topic-opening questions were not significantly associated with rises, rather than with their absences. No significant correlation was found between speaker's gender and the number of rising utterances, or between speaker's role (instruction giver vs. instruction follower) and the rise. As an alternative to the question identification procedure used for the sample, all (*yes/no*-entailing) response-receiving utterances were also analyzed for their association with rises. No statistically significant link was found in the data analyzed from this perspective.

6.5 Summary and discussion

In the two studies reported in the present chapter, a statistically significant link was found between final rises (understood in terms of the INTSINT alphabet as utterance final **T**op, **H**igh or **U**pstep associated with a particular dialogue act) and polar questions on the one hand, as well as topic openings on the other hand. In general, the association of rises with topic openings was stronger than the association with questions. If we assume that questions are usually topic openers (a link confirmed in the Caelen corpus study), the impression that questions in French are usually rising may simply be due to the use of rising intonation on topic openings. Expressed with Gussenhoven's universal codes, the rise on French questions would thus be due to the *Production Code*, rather than the *Frequency Code*, as generally assumed. However, given that topic-opening questions did not appear more likely to be rising than other questions, the two Codes seem to be operating hand in hand. It is possible that, as suggested by Gussenhoven, the type of rise associated with the Production Code (topic openings) differs from the rise expressing the Frequency Code (questions), but the rather coarse-grained INTSINT-based intonational analysis cannot be used to test this hypothesis. Also, it could be the case that the rise is not always aligned with the utterance boundary. A more detailed description of the rise alignment could also account for the use of a number of rises at IP-boundaries not associated with a dialog act (in the pilot study, viz. table (16)) but occurring at points of a major syntactic boundary and possibly signaling continuation.

Chapter 7

Conclusion and Future Work

In the final chapter of this dissertation, I will first summarize the main findings and observations discussed in the earlier chapters, followed by possible future research directions.

In **chapter 2**, which served as an introductory chapter to intonation research, it was argued that a purely auditory analysis of the speech signal, which relies purely on the perceptual impression of the listener, is often unreliable. Both an auditory and an instrumental analysis should be combined in order to annotate pitch contours and, in the ideal case, accompanied by perceptual experiments. Some arguments were raised in favor of the use of real conversational data (as opposed to laboratory data and read speech). I also discussed a number of typological observations and Gussenhoven's three biological codes were introduced. Two types of theoretical approaches to the meaning of intonation were distinguished, here referred to as 'statistical' and 'rule-based'. The chapter also contained an outline of the main research position assumed and defended throughout the thesis. The main points included the assumption that intonation is meaningful at least on utterance level, in particular on the nuclear phrase (starting from the last (nuclear) accent) which can be rising or falling and that its meaning is intrinsic (independent of contextual phenomena) and can be represented with formal linguistic tools.

In **chapter 3**, the central theme I examined was the hypothesis that there exists a typical question contour/set of contours in American English. On the basis of experimental data, it was concluded that the term 'question' is not clearly defined and that speakers (linguists included) tend to interpret it in widely different ways. To circumvent this ontological hindrance, the term 'response seeking utterances' was introduced, with several subtypes based loosely on Clark's ladder; the typical function of interrogatives in discourse was assumed to be 'seeking an evaluative response'. Some criteria for identifying evaluative response-seeking utterances in a conversation were introduced. Subsequently, I discussed the results of an experiment designed to test for contours which speakers perceive as

response-seeking on declaratives. For the experiment, natural data extracted from a conversational corpus were categorized into three groups ('proper declaratives', 'acknowledgment-seeking declaratives' and 'evaluative response-seeking declaratives'), depending on their discourse position and linguistic context. (The category 'evaluative response-seeking declarative' was assumed to correspond to what elsewhere has been called 'declarative questions' or 'question declaratives'.) It was found that this group of declaratives (unlike 'proper declaratives' and 'acknowledgment-seeking declaratives') can be identified by subjects even outside of context. Furthermore, there is a set of contours that facilitates the evaluative response-seeking interpretation (though their presence is neither sufficient nor necessary). These contours can best be captured with Gunlogson's definition of 'final rise' and were here described with broad ToBI alphabet as containing the nuclear tunes L*H-H%, H*H-H% and L*L-H%. Interestingly, it was found that these three contours are a stronger predictor of the evaluative-response seeking interpretation than other properties of the utterance (e.g., the presence of a hetero-cognitive predicate, which is otherwise linked to this particular interpretation as well). At least in this sense, the meaning of intonation is thus in no sense "weaker" than the meaning of lexical items.

The focus of **chapter 4** were rising and falling (polar) *interrogatives* in American English. According to the existing studies, falling interrogatives appear to be biased towards a positive response in some contexts and towards a negative one in others. This discrepancy can be captured by the decision-theoretic approach to the use of polar interrogatives, which assumes that there are two types of bias: one, where the speaker wishes for the proposition of the same polarity to be true, and another, where she expects the proposition with the opposite polarity to hold (in both cases, receiving an affirmative answer results in a higher utility than receiving a negative one). The decision-theoretic description, however, falls short of some corpus examples; this observation was further confirmed in a perceptual categorization task designed to test the association between nuclear tunes and types of bias. In the task, it was also found that final rises are frequently associated with speaker's wish for the affirmative answer to hold (desired state bias), while the low fall is linked to speaker's informational bias towards the negative answer.

In **chapter 5**, the empirical observations made in the preceding chapters were tied to an update semantic formalization, exploiting the supposition that the primary linguistic interpretation of final rises is *uncertainty* (rather than questioning). In terms of the universal biological codes for pitch interpretation, their linguistic and paralinguistic adaptation was thus taken to be the same in American English and the frequent questioning effect of rising declaratives in context was derived from the maxims of rational conversation. I argued that the proposal has a certain number of advantages. For example, it does away with the hybrid category of question/rising declaratives and simply treats them as declarative sentences containing an operator of epistemic uncertainty (the final rise). It can

also account for the use of rising utterances, both declarative and interrogative, in the observed contexts which posed a problem for existing theories, and for the association of rising utterances in general with politeness.

In **chapter 6**, some preliminary findings regarding the use of final rises in French were reported. In two corpus studies, a significant link was found between final rises (expressed with the help of the INTSINT alphabet) and polar questions, as well as final rises and discourse topic openings. While the association of rises with topic openings was stronger than the association with questions (suggesting the operation of the Effort Code), there appeared to be no noticeable tendency to use final rises with topic-opening questions. It was concluded that a more fine-grained system for intonation transcription is needed to explore the issue in detail.

Apart from the specific open points discussed in the individual chapters, there are a number of broad research directions in which the issues raised throughout the thesis could be explored further. First of all, neither the empirical observations, nor their semantic interpretation concerned constituent (*wh*-) questions. Their intonational patterns, however, were observed to differ from those of polar interrogatives in past corpus studies and, therefore, it would be interesting to test the claims made in chapter 5 on utterances containing question words. An important indication that the exploration may not be straightforward comes from the work of [Scherer et al., 1983] who observed that while polar interrogatives with rising intonation are perceived as being more friendly than their falling counterparts, constituent interrogatives exhibit the opposite tendency (with the interpretation being 'critical').

Another issue, already touched upon in the conclusion to the previous chapter devoted to French, concerns the alignment of the rise in the utterance. Here, I was prevalently concerned with rises that were utterance final but it is possible that the contours are also operational on non-final intonational phrases. If so, it would be interesting to investigate if their meaning can be captured with the semantics advocated here (possibly with a different scope of the epistemic operator). Also, it may be the case that utterance-internally, other contours contribute meaning and also facilitate the recognition of (evaluative) response-seeking utterances. A point in case are the findings of [van Heuven and Haan, 2000] who show for Dutch that speakers are able to recognize a question before hearing the terminal. Incidentally, constituent questions – despite their mainly falling rendering – have been claimed to contain high pitch on the question word and it may thus be fruitful to tie this line of investigation together with the previous one.

As already discussed with respect to the French data reported in chapter 6, the Frequency Code (formalized here semantically) appears to exhibit a certain overlap with the Production Code. Not only for French, but also for English, a detailed analysis of the realizations of the two codes is necessary to determine how they are put in use on questions. Not only INTSINT (for French), but also the broad ToBI alphabet are not fine-grained enough for this purpose, since issues

such as pitch range may have to be taken into consideration. It remains to be seen what intonational descriptions will become available in the future that will be suitable also for comparative corpus studies with several speakers.

Appendix A

Three types of declaratives

Symbols:

!	Proper Nouns
-	partial words
X	unidentified noise
(TEXT)	background noise
{text}	speaker noise
((text))	semi-intelligible speech
<text>	foreign language
%	non-lexemes
[Text]	overlapping speech (with indexation)
+BA+	Brief Acknowledgment
+NR+	No Response
+ER+	Evaluative Response

1. Charles: {breath} And on my production card see
   the day before yesterday I did ice cream right
   ((Ballian))?
   Abel: Uh-huh
   Charles: **and you've got to pack those in cases. +BA+**
   Abel: ((Right)).
   Charles: And so like I didn't put that down on my production card.

2. Abel: How many cases you packed?
   Charles: I don't know man.
   I packed two palates. +NR+ You know.
   I don't know how many cases that is, but
   Abel: ((%Uh-huh))
   Charles: {breath} you know, that that shit was heavy man.

3. Charles: {breath} So %um when you went last weekend
   you applied right?

Abel: Mhm.
Charles: They **they hired you. +ER+**
Abel: Right on the spot.
Charles: Right on the spot.
Abel: He gave me interview. He talked to me.

4. Abel: it's okay most men do look at other women. And %uh
you know things go through their mind and everything
but that I'm impulsive.
I'd act on my impulse. +BA+
Charles: Yeah.
Abel: Like I'd see something I'd want it and I'd go after.
Where I where I had a beautiful woman I shouldn't have
thought like that at all.

5. Charles: Right.
Abel: But yet wouldn't mind owning a new car.
Charles: That's right.
Abel: And you've got to talk them into it. You've got to sell it
to them you know.
You've got to get them in your office
{breath} and you've got to sell that car to them.
You can't let them leave without that sale. +NR+
Otherwise they're going to go elsewhere.
Charles: Right.

6. Charles: Yeah. I- but you didn't pack it.
{breath} So I go yeah I go look man
there they are you can see there's my name
i- stamped right on there. I just didn't put it down.
%Oh well I've got to figure it out.
{breath} He goes what are you doing in the cafeteria
so late.
{breath} I'm just going %oh man {breath}
this is the pits, man. This is the bottom of the
Abel: **That's the last thing you wanted to hear. +ER+**
Charles: Yeah. Really. This fucking
Spanish X
You know getting on my case

7. Montoya: . . . Okay
how about you.
. . . How about your parents.
Carolyn: . . . Um,
. . . well my dad was drafted.
Montoya: . . . **He was in Vietnam? +ER+**
Carolyn: . . . Um,
. . . long story,
he didn't make it to Vietnam but,
um,
X [((%H))]
Montoya: [But he was] in the military [2 during that time.

Carolyn: [2 He was in the military at the 2] time,
Montoya: . . . Alright 2].

8. Montoya: . . . With the exception of the death of Cesar
Chavez recently,
((%H)) where there were approximately forty-thousand
people,
. . . to mobilize.
. . . large numbers . . . of people,
into some kind of a . . . effort or movement.
. . . Alright.
. . . ((%H)) **So he's correct. +NR+**
. . . It depends . . . on the time,
. . . depends on the circumstances,

9. Ramon: yeah, more reognized, and,
Montoya: . . . [Alright].
Ramon: [I think] that's a fear factor.
[2XXX2]
Montoya: **[2That is2] a part of the fear factor. +BA+**
Ramon: [3Mhm3].
Montoya: [3((%H))3] I mean uh,
if . . . one lookat what, uh,
Jesse Jackson is doing,
vis a vis ((%H)) . . . who.
. . . The major league?
. . . Baseball teams and all that?
. . . Football and all that?

10. Fred: When did they file?
Didn't you say they file in [eighty-seven]?
Joe: [Eleven of eighty]-seven.
Fred: . . . In eleven?
Joe: . . . Mhm.
Jim: . . . Three months?
Whew.
That's pretty fast. +ER+
Joe: [Yeah.
Fred: [What did they do.
Joe: ((%H))]
Fred: Dis]miss it?
Joe: It was a business –

11. Joe: currently have a debt to income of
twenty-eight over
twenty-seven,
. . . ((%H)) and after the refinance,
they would have a . . . debt to income of fifteen over
twenty-three.
. . . [(TSK) ((%H))]
Jim: [Where are they] now,
. . . **I missed that. +NR+**

		. . . They're fifteen over –
	Joe:	. . . No.
		. . . They're currently . . . twenty
12.	Jim:	((%H)) Because as loan officers,
		((%H)) you have a good ((%H)) handle on . . .
		borrowers and,
		. . . and can kind of tell them of these SEPs,
		and some of the other products.
		((%H)) Uh,
		we've kind of hesitated [in . . . in offering those],
	X:	[((%H))]
	Jim:	((%H)) . . . well,
		we have not offered the self directed. +BA+
	Joe:	[Hm.]
	Jim:	[((%H))] Offering the self-directed we're getting,
		is simply,
		((%H)) we need to get a dif- –
		fifty different forms.
13.	Marci:	[it's a] good brand,
	Kendra:	. . . [2{gasp}2]
	Marci:	[2((%H)) y2]ou can get the bags at,
		. . . at . . . United Vaccum?
	Kendra:	**I have to buy bags? +ER+**
	Marci:	. . . N-yeah,
	Kendra:	. . . I'm not gonna have money.
		. . . Not bud[geted].
	Wendy:	[((%H))] Honey they last forever.
14.	Kevin:	. . . Well that's helpful.
	Ken:	That's nice.
	Kendra:	**It's only hundred and fifty bucks, +NR+**
		. . . I think I can afford it.
	Kevin:	. . . [A year?]
	Marci:	[Appease] [2the monster.
	Wendy:	[2That is micro2][3wavab3][4le4].
15.	Ken:	Do you want the end] one,
		[2or do you want the2]
	Kendra:	[2You take the end 2] one,
		it's got [3 nuts on it 3]. +BA+
	Kevin:	[3((%H))3]
		. . . (FOOD) Mm. (FOOD)
	Wendy:	. . . (FOOD) %Oh that's good frosting.
16.	Rebecca:	Okay. . . . So round trip it'll be like
		. . . t[wo seve]nty.
	Rickie:	[two si-] – Yeah.
	Rebecca:	. . . (PAPERS) (WRITING)
	Rickie:	. . . {sniff}
	Rebecca:	. . . **That's from Salinas? +ER+**

Rickie: . . . Mhm . . . {sniff}
Rebecca: . . . (WRITING)
Do you go by !Rickie !Reeding- R- !Reeding !Rollins,
or do you . . . just go by !Rickie !Rollins.

17. Rebecca: ((%H)) um, the jurors that are in there,
. . . there'll be twelve people seated in the juror box,
Rickie: . . . [Mhm],
Rebecca: [((%H))] an[2d u2]m,
Rickie: [2{sniff}2]
Rebecca: . . . you know they could be your family.
. . . **They could be your friends. +BA+**
Rickie: [Mhm],
Rebecca: [((%H))] Um,
they're all,
%% y- y- from all walks of li[fe,
Rickie: [Mhm].

18. Rebecca: [your] husband will be there, ((%H))
%um, . . . ((TSK) and,
. . . then, . . . **there are two tables right here. +NR+**
. . . I'll be seated at this table.
Rickie: [Mhm].
Rebecca: [((%H))] And,
. . . the defendant
. . . and the defense attorney will be seated at this table.

19. Lindsey: . . . I'm trying to remember, I think,
. . . like,
. . . with the [X white X],
Marcia: [X You got X] –
I thought you X-rayed it.
. . . **You x-rayed it with the cast on. +ER+**
Lindsey: Yeah.
[Mhm.]
Marcia: [XX]
Yeah.
Lindsey: yeah, . . . yeah.
. . . and it was ready to come off,
and we took it off,
. . . She did a real good job of [X keeping it X] –

20. Marcia: . . . But, . . . still, it's more
. . . expensive.
Lindsey: . . . I think it'll do fine with a cast.
especially since it's a spiral fracture.
Marcia: **And it's not displaced. +BA+**
Lindsey: And it's not displaced.
. . . should be pretty stable.
It'll be kind of a pain getting the –
. . . well, . . . maybe not, getting the cast over the stifle?

21. Marcia: [And that one] really, . . . you know,

I don't think it would benefit from pins,
Lindsey: [because],
we'd have to undo it. +NR+
I mean we'd have to,
((%H)) Well, we'd have to go,
. . . we could –
we could try it closed.

22. Marilyn: so did we decide we do or do not want potatoes.
Roy: . . . I think potatoes are excessive.
I think we have enough food here.
Marilyn: Peter?
Pete: . . . %Um, . . . that's fine.
Marilyn: Okay.
Pete: . . . No [potatoe]s,
Marilyn: [We have] - -%um,
Pete: **We're having like salad and fish? +ER+**
Marilyn: . . . unhunh, . . . and . . . gre-
. . . green beans?
Pete: Yeah.
Marilyn: . . . We can make %um, . . . garlic bread or something.

23. Pete: . . . They just built a . . . a great big gray water processing center, . . . at the laundromat, . . . in the . . . complex where I live.
Marilyn: . . . %Oh.
Pete: **It's like right outside our back door. +NR+**
. . . There's all [these] huge machines and stuff,
Roy: [Great m-] - -
Pete: that like . . . filter it and all,

24. Pete: [2 Nutty 2] sesame? Or - -
. . . What is this.
Marilyn: . . . [Sourdough].
Pete: [Poppy] seed?
Roy: . . . Are they?
Pete: . . . No. . . . **It's the mold. +BA+**
Marilyn: . . . [%Oh] yeah?
Roy: [%Oh].
Marilyn: [2%Oh2].

25. Marilyn: [2 He's going 2] back to %um,
Pete: [2 so he- 2] - -
Marilyn: . . . Nepal. . . . And, . . . India too,
. . . when.
November. . . . ¡P Make me X X P¿.
Roy: **Those are not all related languages. +ER+**
Pete: . . . No. . . . [They] aren't.
Marilyn: [What].

Pete: . . . They – they just all happen to be
Southeast Asia.
Roy: . . . (FOOD) %Oh.

26. Marilyn: who's doing [2this,
Roy: [2this is like,
Marilyn: UC Davis2].
Roy: **This is like some kind of horrific nightmare. +NR+**
I read about [3this3],
Pete: [3This3] - -
Roy: this is [4tube chickens4].
Pete: [4That's horrible4].

27. Roy: It's not like a . . . big [system] some[2where2].
Pete: [Right].[2 Yeah 2].
Roy: **You get your own [3grey water3] system. +BA+**
Pete: . . . Yeah.
Marilyn: [Yeah,
Pete: [But this is like] –
Marilyn: but . . . it's a] . . . complex.

28. Jim: %That's pretty much the end of it].
Michael: creative people generally] do what they love [2to do2].
Jim: [2((%H))2] Yeah, right.
. . . And that's pretty much the end of the truthful
part of the process.
((%H)) **the rest of it is all marketing. +BA+**
Michael: . . . Hm.
Jim: and the marketplace is uh, . . . you know,
. . . maybe I think I live in Tangiers.
((%H)) you know?
. . . Maybe I think the marketplace is [uh],

29. Jim: . . . It's just a set of instructions,
I used to program.
((%H)) a little bit, and, ((%H)) and um,
((TSK) ((%H)) **those guys have so much fun writing**
those programs. +NR+
. . . you know,
. . . that's the% - -
. . . I think that's - -
. . . [that's pretty - -
Michael: [((TSK) ((%H)) Yeah well,

30. Michael: . . . He had a lot of real . . . wacky ideas
on . . . big levels.
He wanted a world power system,
((%H)) that you could %um,
. . . tap into the air basically,
and get power anywhere on earth.
((%H)) and %um,
((%H)) [y-] –

Jim: **[that's what the] Tesla coil was about? +ER+**
Michael: Yeah. . . . e- the problem was, that it,
. . . it uh, ((%H)) it interfered with %um, {swallow} . . . well,
matter. X X I mean, y- – it was not a clean broadcast system.

31. Michael: . . . Each . . . p-scientist has their, ((%H))
. . . their field of %um,
. . . expertise, . . . and if they're gonna go,
. . . if they're gonna stretch out far enough into the% - -
. . . the unknown.
. . . where they can find something new.
((%H)) **They have to do it in a straight line. +BA+**
They can't [do it,
Jim: [that's true]
Michael: ((%H))] in all directions at once.
Because then you run into things that we already now.

32. Jim: that's what I thought that they did any[ways].
Michael: [Yeah?] . . . hunh. . . . **they certainly**
use her a lot. +NR+
. . . But I mean it- - -
they only use, what.
a s- % - - five seconds total or something?

33. Michael: . . . ((%H)) %Um], but, ((%H))
it's still not the totality of a plant. +ER+
Jim: No it isn't, by any stretch.
But for mathematics or for science, it's the- - -
[it's an opportunity for them to - -

34. Phil: [needs], . . . you know. . . . I would like
to create. . .
collections committee to be something where we're almost matching?
Brad: . . . Yeah.
Phil: . . . % . . . **Funds they can raise maybe? +ER+**
Brad: . . . Unhunh. . . . [Yeah.]
Phil: [You know.] If they can raise ten grand.
Brad: X Well, . . . XX [X ((%H))]

35. Phil: [((%H)) Okay], you know, these are- - - [these are roo]ted,
Brad: [I know]. [2Jeez2].
Phil: [2obviously2] in a personal . . . ((%H)) issue, . . . [3((%H))3]
Brad: [3Yeah3].
Phil: . . . %Um, **!Teresa is a very sensitive person, +NR+**
. . . she f- - -
. . . you know,
% . . . I don't - - I have no doubt that she believes,
. . . what happened happened.
((%H)) [But],
Brad: [((%H))] Well but,
Phil: My- . . . my feeling is, . . . as I told them,
I said, ((%H)) if it's that issue, . . . I says,

36. Brad: [2 It would formalize it too much? Or 2],
Phil: . . . ((%H)) I want - – it 2] formalizing it, but it's also say- –
I want it to come to the resolution that,
. . . **things aren't that bad. +BA+**
Brad: Mhm. . . . ((TSK) ((%H)) [No.
Phil: [% and that what %] - -
Brad: i] - -
Phil: what we - - and things aren't that bad.

37. Alice: . . . he was going to uh, . . . ((%H)) !Peggy,
Mary: . . . {swallow}
Alice: {yawn} {yawn} **you remember !Peggy !White? +ER+**
Mary: . . . ((TSK) Yeah.
Alice: Her husband, !Gary !Bighare?
Mary: Mhm?
Alice: . . . Him and her pulled up,

38. Alice: Mhm, . . . and [he earns] leave,
Mary: [he's] - -
Alice: . . . **he gets sick leave, +NR+**
. . . we don't get shit.
Mary: . . . ((TSK) I don't know.
. . . ((%H)) . . . It is really hard living with another couple.

39. Alice: he goes %um, . . . what was it he goes,
. . . nobody fucks with my lifestyle.
. . . XI fell the exact same way.
. . . And all those bitches and complaints he has,
((%H)) **they're about my life style. +BA+**
Mary: . . . Mhm,
Alice: And he doesn't realize that.
Mary: . . . {throat}

40. Alice: Why.
Mary: . . . Cause !Phoebe needs it.
Alice: . . . What's wrong with the car. . . . ((%H))
Mary: **%Oh, you didn't hear about it? +ER+**
Alice: %Hunh-unh.
Mary: . . . %Oh, you did, about how the . . . engine was on fire?
Alice: . . . Mhm.

41. Alice: . . . What are you gonna do with it.
Mary: . . . **She wants to set it up for her Barbies. +NR+**
. . . I was just gonna use a tin can and put rocks in the bottom?
Alice: . . . %Mhm.
Mary: . . . And just stick it in there.

42. Alice: . . . I don't know if she'd do it.
Mary: . . . I don't know if she would either.
. . . **She's kind of timid. +BA+**
Alice: . . . %Mhm.
. . . She doesn't trust too many people at all.
Mary: . . . Yeah.

43. Jennifer: the object is not to have any points. . . . And,
((%H)) you play following suit,
. . . and, . . . you can take, if you take tricks,
th- the highest card of the suit, takes the trick.
If you don't have the card of the suit,
[you throw] ((%H)) whatever you want. +BA+
Dan: [((%H))] Okay. So h- hearts, . . . and the queen of spades.
Jennifer: Are [bad].
Dan: [are the] only thing.

44. Dan: . . . Go for that one. . . . Go into Europe.
Get Europe. . . . {whistle}
Jennifer: Oop. . . . **You won't attack me yet. +NR+**
. . . ((TSK) I think I'll stop there.
Dan: . . . X %Hmm.
Jennifer: . . . ((%H))
Dan: I only have uh, . . . that many cards, so, ((%H))
Jennifer: ((TSK) How many cards you have.

45. Dan: [Let's check that one out]. . . . X y-neat X - - -
. . . wait, . . . play X novice X.
I've never played hearts be[fore in my life],
Jennifer: [((%H)) **You've never] played hearts? +ER+**
Dan: . . . No, I don't know how to play it.
Jennifer: . . . %Oh. . . . Okay. I'll teach you.

46. Doris: And her heart, . . . was just hard,
on one side, from
((%H)) labored breathing all of her life.
It had just labored her heart so bad.
((%H)) She actually died of a heart attack.
Lynne: **She did. +ER+**
Doris: Yeah.
Lynne: . . . They did have an autopsy done on [her].
Doris: [Yes]. . . . It surprised me. . . . But they - - they did.

47. Lynne: ((%H)) !Jorgensen's have a . . . girl- - -
. . . or a g- - -
. . . you know a guy,
they've had a guy being a horseshoer for,
a long time you know?
((%H)) And they,
are %um, . . . ((TSK) there's this girl,
that's working with him, for the summer?
Doris: %Unhunh.
Lynne: **And she's gonna be a ferrier. +BA+**
Doris: . . . Yeah.
Lynne: . . . I couldn't believe it.
¡HI And she's just little HI¿.
. . . She's a tiny girl.
but, boy I tell you,
she's got arms the size of - -
. . . ((%H)) they're huge.

48. Lynne: . . . we had in it another class too.
we- - ((%H)) that was kind of a double thing that,
% we had in- - - . . . in another class,
so it was kinda review for us +NR+
((%H)) well it was a review for some people,
depend on what time of the year you took it.
You know.
((%H)) if it was a review or not.
((%H)) But,

49. Jennifer: . . . I'm gonna conquer - -
I'm gonna conquer you WH.
Dan: X . . . [((%H)) Probably].
Jennifer: X
Dan: . . . %Oo. **He's giving you some problems over there. +BA+**
((%H))
Jennifer: ((%H)) He is indeed.
Dan: . . . Go for that one.
. . . Go into Europe. Get Europe. . . . {whistle}
Jennifer: %Oop.

50. Jennifer: ((%H)) . . . Are you gonna attack over there?
Dan: . . . ((TSK) I don't know. . . . Thirteen.
That leaves me with thirteen. +NR+
((%H)) I wanna fortify,
Jennifer: . . . You can't move those to there,

51. Jennifer: . . . ((TSK) ((%H)) X You remember?
Dan: . . . Yeah.
Jennifer: . . . Look at you being smart.
Dan: **I'm not smart? +ER+**
Jennifer: . . . You're stupid X.
Dan: . . . Don't call me stupid.
Jennifer: %Mm. . . . {kiss} . . . Alright.

52. Miles: He's bigger than [I am].
Pete: [XX], XXX
Miles: **He's not bigger than you. +ER+**
Pete: . . . No.
Harold: X [But he's my] - -
Miles: [XXX]
Harold: he's my [2 friend 2] X.

53. Miles: [3 Is that why they look so different 3]?
Jamie: [3XX ((%H))3]
Harold: . . . %Uh-oh.
Miles: I mean, . . . i%- –
. . . **Well you see their eye balls, +BA+**
[I guess].
Pete: [Right].
. . . Yeah [2 the other 2] - -
Miles: [2 In addition 2] to a mustache and a beard.

. . . But the thing is,
[that second one looks like the guy]
who was in [2 one of the 2] [3 Oba Oba skits 3].

54. Harold: . . . Is it the % - -
. . . the way their little beard goes?
Jamie: . . . X[XX]
Miles: [%Oh no]. **It's not even relevant. +NR+**
I- d- - -
I just glanc[ed at] that,
Pete: [%Hunh].
Miles: and I immediately saw this guy's face in Oba Oba.

55. Kathy: . . . Okay, so you have fifteen fourth-graders,
and five third-graders?
Sharon: ((%H)) Na- - - . . . Uh no. . . . I have like seventeen
fourth-graders
and five third-graders.
Kathy: All you have is twelve kids?
Sharon: . . . What?
Kathy: **You only have twelve kids? +ER+**
Sharon: ((%H)) No. . . . Seventeen
Kathy: %Oh, okay.

56. Kathy: When you [2 have them in 2] groups
wor[3king on something3],
Sharon: [2I have2], [3I have3].
Kathy: ((%H)) **It shouldn't be . . . multiple choice. +NR+**
It shouldn't be,
Sharon: . . . ((TSK) It isn't.
Kathy: something easy. . . . They should - -
. . . They should have to,
Carolyn: [Write it out?]

57. Kathy: [Yeah but, is the form in Eng]lish?
Sharon: . . . ((%H)) They have a form in Spanish [also].
Kathy: [Well, even if] it's in Spanish,
maybe they can't read. +BA+
Sharon: . . . Well - -
Shane: Yeah.
Carolyn: [%Mhm].
Sharon: [That's] very probable, you know,

58. Darryl: . . . What does that have to do with heaven
and hell in the book.
Pamela: . . . Well, . . . % I'm just sort of reiterating.
. . . **I could read you some. +ER+**
Darryl: [No.]
Pamela: [I] mean is that allowed?
Darryl: . . . No I I don't want to hear anything out of a book with,
. . . chapter called heaven and hell.

59. Pamela: And it really was - - S- what was hell in that
... that marriage became,
... became a way out for me.
... It was the flip side. +NR+
((%H)) ... It's like sometimes you go through things,
... and you come out the other side of them,
X you X ... come out so much better.
... ((%H)) And if I hand't had that,
if I hadn't had - -

60. Pamela: And then we went to the Chalk ... Fair,
and then he took off with !Tobias?
Darryl: The Chop Fair?
Pamela: The Chalk.
Darryl: [%Oh,
Pamela: [The Chalk Fair].
Darryl: ... %unhunh]?
Pamela: ((%H)) **And he took off with !Tobias? +BA+**
Darryl: Yeah?
Pamela: ... Is that, that, ... that ... I wanted to say with him
well your dad wanted to spend time with you today.
... And why did you run off.
... ((TSK) And I didn't,

61. Randy: ((%H)) and from bravo, and from alpha.
... You know, %
the sequence can't be too bad,
I mean all [he did],
Lance: **[You got some]thing you can do. +ER+**
Randy: Yeah.
... All he did is send em all out.
I mean [you got all the] West Coasts in the row over on charley,
Lance: [XX]
Randy: you got the jets in a row on bravo,
and got n- various things over here.

62. Lance: For the most part, ... I mean I was able to k- - -
... I think I was able to keep up with that stuff,
Randy: With the ARTS.
Lance: ... Yeah. I mean, XX **there was really**
nothing much to do. +BA+
[((%H)) %um],
Randy: [No, there wasn't.]

63. Lance: ... ((%H)) and so there was that,
I didn't have any ARTS entries, +NR+
I had, ... you know, Traffic Watch to slue out to,
Randy: {yawn}
Lance: %um,
Randy: {yawn} ... Yeah.

64. Darryl: ... ((%H)) So why are you reading a book about dying,

Pamela: . . . I don't know.
Darryl: . . . **you don't know? +ER+**
Pamela: . . . I have an interest in it.
Darryl: Why. . . . You're alive.
Why are you reading a book about dying.

65. Darryl: yeah but . . . but . . . but, % to me the whole point is is,
. . . you have no idea, what happens before or after.
. . . **You have no idea. +NR+**
. . . You can read books about it,
and you can . . . ((%H)) talk about it,
. . . but the most pragmatic thing to do is,
to just . . . live it.

66. Darryl: . . . You have no idea. . . . You can read books about it,
and you can
. . . ((%H)) talk about it,
. . . **but the most pragmatic thing to do**
is to just live it +BA+,
Pamela: . . . %Hm.
Darryl: . . . Learn the rules of the game, . . . play the game.
Pamela: For what.

67. Alina: . . . Okay. ((%H)) . . . Two weeks ago I'm watching TV,
. . . and David Horowitz is going to have,
this former car . . . radio thief on?
LenoreII: . . . **It's her boyfriend? +ER+**
Alina: ((%H)) . . . Yeah, her ex-boyfriend. . . . !Mike.
. . . He's the one that stole Hector's radio.
LenoreII: . . . How do you know.

68. Alina: . . . ((%H)) He was not allowed to help on any of em.
. . . None of em.
LenoreII: . . . **That's changed now though, +NR+**
he can be, . . . like he was before again,
Alina: ((%H))Yeah.
LenoreII: edit],
and the neurotics [2are2] out.
Alina: [2((%H))2] Well, what's gonna happen,
that he is editorial.

69. Alina: . . . ((%H)) He was not allowed to help on any of em.
. . . None of em.
LenoreII: . . . That's changed now though,
he can be, . . . like he was before again, +BA+
Alina: ((%H))Yeah.
LenoreII: edit],
and the neurotics [2are2] out.
Alina: [2((%H))2] Well, what's gonna happen, that he is editorial.

70. Miles: Who suggested this to em.
Harold: **I have no idea. +NR+**
It was probably my . . . sister-in-law's idea because,

. . . I think they saw . . . that movie.
Jamie: . . . Tap?

71. Jamie: . . . [Well],
Miles: [X],
Jamie: I mean maybe - -
Harold: . . . **That was actually very profound. +BA+**
Jamie: X Yeah, XX that was X. XX ((%H))
Maybe you can just go up to a woman, and, you know,
do that kinda thing.
Harold: Yeah. You X - - You wind up [getting] punched.

72. Miles: . . . No sooner did I think this thought,
guys were over there, ((%H))
Harold: . . . What-, . . . **you didn't ask her to dance? +ER+**
Jamie: . . . Not Miles, [he's just in daze].
Miles: [Well I was still trying to] figure out,
Jamie: . . . X
Miles: surely they must know each other,

73. Joe: . . . Their assets total one sixteen four seventeen,
((%H)) . . . their liabilities ((%H)) eighty . . . -three,
. . . ((%H)) . . . their . . . net worth . . . thirty-one.
Fred: **[So all they] owe is the house? +ER+**
Joe: [((%H))]
%Mhm.
. . . ((%H)) They %um,
. . . [((TSK)]
Fred: [T- T-] T-.
Joe: currently have a deb to income of twnety-eight
over twenty-seven
. . . ((%H)) and after the refinance,
they would have a . . . debt to income of fifteen
over twenty-three.

74. Jim: Now I think a hundred fifty dollars ((%H)) is a lot,
((%H)) [to maintain] a self-directed IRA.
Fred: [%Mhm].
[2So you mean2],
Jim: [2%X2]
Fred: . . . that you - -
we could pass that back to the customer. +BA+
Jim: [Right.]
Fred: [That's] what you're saying,
Jim: Right.
[((%H)) We] - -
Fred: [They] charge us five-hundred plus thirty-five per account?
Jim: . . . Well he- he thought –
he's gonna send me down the information,
you know how the typical salesman

75. Fred: . . . And, . . . he had . . . initially thought

what he borrowed would do it,
and then he borrowed some money from his uncle,
and he wants to repay his uncle and get that out of the way.
((%H)) **He wants to set it up on a year, +NR+**
. . . %uh,
it would be secured via three vehicles,
. . . %um,
. . . you know his debt to income is relatively high
but his income's going up
. . . the daycare is scheduled to open

76. Melissa: . . . They weren't really important,
but I did skip two of em?
. . . and so now I'm paranoid that I'm gonna skip
a bunch more,
so I have to go back,
does it matter?
Jan: . . . No, **at this point you should be making progress. +BA+**
Melissa: . . . ((%H)) Okay.
Frank: {sniff}
Jan: . . . Your ten minutes are up.
Melissa: . . . And I've proofread the whole thing.

77. Melissa: . . . ((%H)) Just two more. . . . actually,
(PAPERS) that.
Jan: ((%H)) okay, **I'm gonna check on you in ten minutes, +NR+**
if you haven't gotten one page done,
in ten minutes [you'll go-] - -
Melissa: [One side] of a page?
It takes me a long time,
because I've got to go over the sentences,

78. Frank: Well it looks like I'm not gonna do that.
Well I can't do it this weekend any[way].
Jan: **[You] weren't gonna do it this week[2end2]. +ER+**
Frank: [2((TSK)2] Yeah.
Jan: [He said we could] - -
Melissa: [What should I wear for] Halloween?

79. Doris: [2I2] had a a, . . . an X-ray, what.
Sam: . . . [X-ray],
Doris: [Heart] - -
Sam: an EKG, and blood work.
Angela: . . . Really.
Doris: ((%H)) [X]
Angela: [¡X Well is] [2the do- X>2] - -
Sam: **[2They haven't2] called you on the blood. +ER+**
Doris: No.
Sam: . . . We should get a, . . . %a paper today.
They were gonna send a . . . copy.

80. Angela: . . . You have to expand, . . . or something,
Doris: . . . [((TSK)]
Angela: [to keep] . . . ¡MRC in the main stream MRC¿.
Sam: . . . ((TSK) . . . Well,
and so many times when they expand,
they've ((%H)) expanded,
and then things dropped back. +BA+
Angela: . . . Yeah.
Sam: . . . But this Wallmart needs,
. . . % needs a larger building.
Angela: . . . [Yeah].

81. Angela: ((%H)) I call in and let you- - - . . . whoever it is,
((%H)) know I'm up.
Sam: ((%H)) [Well],
Doris: [%Oh].
Sam: **you can do that with us. +NR+**
. . . [We're up ((%H))] - -
Doris: [You can do it with X-] - -
%% you can do that with us,
. . . ((%H)) sometimes we're up at four o'clock.

82. Sam: [you hate to] start out . . . at ten o'[2clock2].
Doris: [2I'd2] say eight, . . . and quit at four.
Sam: X[X]
Angela: [((%H))] **You know the little folks**
who live above me, +ER+
Doris: [2((%H))2] %Mhm.
Angela: . . . ((%H)) go over to . . . Tucson Mall,
and [walk] every [2morning2].
Doris: [{sniff}] [2Yeah2]. . . . [3That's good3].

83. Angela: . . . you know, . . . I think I'd hate to be
in business right now.
Doris: . . . %Oo.
Angela: . . . **You can't . . . sit . . . still. +BA+**
Doris: . . . %Hm-m.
Angela: . . . You have to expand, . . . or something,

84. Angela: . . . this - - . . . ((%H)) See where I sewed right down
the middle of that.
Doris: Yeah?
Angela: **Otherwise it would balloon out? +NR+**
. . . ((%H)) And so I s-,
((%H)) . . . put it on the machine,
and sewed right down through the middle of it. [((%H))]
Sam: [So it doesn't] gap.

85. Doris: . . . You smoked it down into the . . . cork, didn't you.
Angela: . . . Pardon?
Doris: . . . ((%H)) **You smoked it down into the cork. +ER+**
Angela: . . . ((%H)) Well, yeah, you don't [like that].

Doris: [{throat}]
Angela: Do you but - -
Doris: . . . ((%H)) No, it chokes me to death.

86. Doris: and she followed through, and told about her husband,
. . . ((%H)) you know?
ENV: . . . (DOOR)
Doris: Not necessarily that she would approve of it,
. . . **but at least she wasn't disapproving +BA+**
Angela: . . . Yeah.
Doris: . . . of it.
Angela: Yeah.
Doris: . . . {sniff} And uh, . . . ((%H)) course !Duvall might- –

87. Doris: . . . {sniff} And uh, . . . ((%H)) course !Duvall might- –
% **and I...I cannot get over this. +NR+**
. . . That man.
. . . I really cannot.
. . . ((%H)) And you know, . . . he must have been thinking,
. . . when he said he wasn't a political appointee,

88. Female2: Is it too lose?
Female1: No. It's ((wonderful)).
Male1: Well yeah. **I didn't make it tight enough. +BA+**
Female1: %Hm.
Female2: %Oh.
Male1: People normally do this their selves ((Gracece)).

89. Female2: It's something simple.
Male1: % Oh all right.
Female2: {laugh} {breath}
Male1: **That's all right. +NR+** I like that.
Female2: All right, ((this))
Female1: The they go- they got roller blades for Christmas.

90. Female2: No, no, you should open, you should open
that one next.
Because that's from !Devon.
Female1: % Oh okay.
Male1: **That's a real candy cane. +ER+**
Female2: Yeah.
Female1: Yeah.
Female2: But be careful because they break easily.
Female1: %Uh-oh. Yeah.

91. Female1: Okay. Here, !Richy.
Female1: %Oh, thank you, mom.
Female1: **This is from Susie and Graham. +BA+**
Male1: %Oh. (X)
Female1: I'm going to open this now.

92. Male1: Okay. Thank you !Devon. Appreciate that.
Female1: Now !Devon. **You can be warm now. +NR+**

{laugh} In Santa Barbara you'll be warm. {laugh}
Male1: It's supposed to be one size fits all,
but they forgot that for people over six feet tall.

93. Female2: Everyone wants a !Mickey !Mouse watch sometime in their life.
Female1: {laugh} {breath} **%Oh you got a Mickey too? +ER+**
Female2: X ((it's))
Male2: Yeah. I got it from !Disneyland.
Female1: {breath} %Oh how neat. {breath} Okay. Open this one.

Appendix B

Map Task Corpus Annotation

Symbol	*Meaning*
H	High
U	Upstep
T	Top
IP	Right-edge Intonation Phrase boundary
DA	Dialog Act (followed by type)
X	pause

KI Annotation

1. i: euh, oui, H IP bonjour, IP excuse-moi. H IP DA *ass com*
2. est-ce que U tu pourrais m'indiquer quel chemin pour aller
3. au but H IP s'il te plait. U IP DA *qyn ir*
4. k: oui, T IP DA *ass qap*
5. alors euh, IP DA *ind*
6. donc, tu... U IP pars euh IP à côté
7. de la station balnéaire ? T IP DA *ass par*
8. i: oui. T IP DA *ass ack*
9. k: oui. H IP DA *ass ack*
10. i: à gauche de la station? IP DA *qyn pre*
11. k: à gauche de la station, IP oui. IP DA *ass qap*
12. k: et euh là il y a le début IP c'est ça ? IP DA *qyn dr*
13. i: oui. IP DA *ass qap*
14. k: donc tu passes à côté de la station IP toujours euh à gauche, IP DA *ass par*
15. i: oui. IP DA *ass ack*
16. k: pas euh IP vraiment droit, U IP mais un petit peu euh IP DA *ass pre*
17. i: oui T IP DA *ass ack*
18. k: un petit peu en arrondi sur la gauche, U IP DA *ass pre*
19. i: en arrondi U qui tourne à gauche ? U IP DA *ass ack*
20. k: non, non, IP tu tournes pas à gauche, IP DA *ass cor*
21. tu continues toujours comme si tu allais tout droit, U IP DA *ass psr*
22. mais ça fait un petit virage quoi. IP DA *ass pre*
23. i: d'accord. IP DA *ass ack*

24. k: et après la station balnéaire IP il y a U euh IP un nouveau phare IP DA *ass ir*
25. i: oui H IP DA *ass ack*
26. i: et, H IP est-ce que tu as des dunes H à côté du nouveau phare H IP DA *qyn ir*
27. k: non H IP DA *ass qap*
28. i: non IP DA *ass ack*
29. k: il y a euh U IP l'océan gris T IP DA *ass ir*
30. i: non, T mais les dunes T sont de l'autre côté IP DA *ass cor*
31. k: de l'autre côté IP non. IP DA *ass rej*
32. k: il n'y a pas de . . . IP DA *fxd*
33. par contre, IP il y a IP un ancien abri antiatomique IP DA *ass ir*
34. i: ah non U IP je ne la vois pas. IP DA *ass rej*
35. k: t'as pas de IP DA *fxd*
36. alors, c'est IP par rapport au nouveau phare T IP un petit peu au dessus. IP DA *ass dr*
37. k: en face, U IP je sais pas, U IP à la droite de H IP de l'abri antiatomique H IP DA *ass dr*
38. i: oui. T IP DA *ass ack*
39. k: il y a les forêts immenses IP DA *ass ir*
40. i: d'accord U IP DA *ass ack*
41. i: alors H par rapport au phare et à l'abri T IP DA *ass loc*
42. je vais. . . H IP DA *fxd*
43. k: donc, tu, IP donc, après H avoir passé devant la station balnéaire U IP
44. tu continues, T DA *ass par*
45. tu passes IP aussi devant le phare T IP DA *ass pre*
46. à la gauche du phare H IP DA *ass pre*
47. i: très loin, H IP ou ? IP DA *qyn pre*
48. k: non, non, juste U IP juste à côté, hein IP euh DA *ass qap*
49. un demi-centimètre IP DA *ass pre*
50. k: vraiment très près du phare IP DA *ass pre*
51. i: oui. T IP DA *ass ack*
52. k: ça va, IP DA *fxd*
53. la route va U un petit peu sur la droite, U IP mais légèrement, U IP DA *ass psr*
54. c'est pareil, U IP DA *ass com*
55. k: c'est un petit virage, U quoi, IP très léger. T IP DA *ass pre*
56. i: oui. IP DA *ass ack*
57. k: et donc après, T IP ça retourne T un peu, IP DA *ass psr*
58. ça cou IP ça euh. IP DA *fxd*
59. k: t'as les forêts immenses sur ta droite, H IP DA *ass pre*
60. donc, tu IP DA *fxd*
61. k: et à gauche H le IP l'ancien abri antiatomique IP DA *ass ir*
62. i: oui T IP DA *ass ack*
63. k: donc, IP tu passes entre les deux T IP DA *ass par*
64. k: mais U tu passes plus H près des forêts immenses H IP
65. que IP de l'ancien abri antiatomique IP DA *ass pre*
66. i: oui. T IP DA *ass ack*
67. k: donc, IP là t'as IP DA *fxd*
68. i: je passe IP donc U IP , au dessus des forêts immenses T IP DA *qyn pre*
69. k: ouais, IP DA *ass qap*
70. tu vas pas sur la droite, hein ? DA *ass psr*
71. i: non. T IP DA *ass ack*
72. k: tu continues toujours IP euh à peu près U tout droit, quoi. H T IP DA *ass psr*
73. i: oui. T IP DA *ass ack*
74. k: et tu vas arriver un petit peu plus haut, H IP DA *ass psr*

75. ya IP à droite, U les torrents effroyables U IP DA *ass ir*
76. i: oui, H IP c'est ça. T IP DA *ass ack*
77. k: et à gauche T IP des champs inondés U IP DA *ass ir*
78. i: oui. H IP DA *ass ack*
79. k: et euh IP oui, IP DA *fxd*
80. ça fait une ligne IP un petit peu au milieu. U IP DA *ass dr*
81. k: enfin ça se rejoint. T IP un petit peu IP DA *ass dr*
82. i: oui, les torrents oui euh oui T IP DA *ass ack*
83. k: donc euh H IP tu continues, U DA *ass psr*
84. ça fait .. T IP DA *fxd*
85. k: une fois H que t'as passé les forêts immenses T IP DA *ass loc*
86. k: ça fait un p- IP DA *fxd*
87. k: c'est pareil, U IP DA *ass com*
88. ça va H un petit peu sur la droite U IP DA *ass psr*
89. en... IP enfin, ça tourne un petit H peu, quoi. IP DA *ass pre*
90. k: mais toujours en allant à peu près tout droit. IP DA *ass psr*
91. k: jusqu'à euh T IP le le torrent T qui rejoint H IP les champs inondés IP DA *ass par*
92. i: et là H je passe U par-dessus U le torrent T IP DA *qyn par*
93. k: tu passes, oui, H IP DA *ass qap*
94. tu... U IP DA *fxd*
95. k: ton chemin passe euh sur le torrent IP ouais. IP DA *ass par*
96. i: oui. T IP DA *ass ack*
97. k: et se rapproche U des champs inondés IP DA *ass par*
98. donc un petit peu sur la gauche. IP DA *ass pre*
99. i: oui. IP DA *ass ack*
100. k: donc le chemin passe très très près U des champs inondés T IP DA *ass pre*
101. i: oui. IP DA *ass ack*
102. i: est-ce que tu as H un désert U sec ? IP DA *qyn ir*
103. k: non IP DA *ass qap*
104. i: qui se trouve IP entre les champs inondés U et les torrents effroyables IP
105. mais un peu plus au dessus. H IP DA *ass dr*
106. k: sur la droite H IP ou sur la H IP gauche ? IP DA *qal dr*
107. i: euh entre les deux, H IP carrément dans le creux. T IP DA *ass qap*
108. i: tu sais, t'a la H IP le champ U ça fait une bosse H à un moment ? T IP DA *ass dr*
109. k: ouais IP DA *ass ack*
110. i: enfin, dans le dessin IP DA *ass dr*
111. k: mhmm IP DA *ass ack*
112. i: et les torrents H IP ça fait des pics IP DA *ass dr*
113. k: ouais H IP DA *ass ack*
114. i: ben, il se trouve à un t'as un creux H IP DA *ass dr*
115. il se trouve IP à ce niveau là U IP
116. mais un tout petit peu plus haut U IP cinq centimètre au dessus IP DA *ass dr*
117. k: hum, IP d'accord. IP DA *ass ack*
118. k: est-ce que H t'as U sur la gauche H IP en dessus des champs inondés T IP
119. deux U fermes abandonnées IP DA qyn ir
120. i: non. IP DA *ass qap*
121. k: non. IP DA *ass ack*
122. k: alors elles sont U IP juste au dessus des champs inondés U IP DA *ass dr*
123. i: oui. T IP DA *ass ack*
124. k: enfin à peu près, DA *ass dr*
125. je sais pas euh IP DA *ass com*

126. i: au dessus T de l'arrondi qui fait U colline T IP ou un petit peu plus à gauche. IP DA *qal dr*
127. k: un petit peu plus à gauche IP DA *ass qap*
128. k: pas beaucoup IP DA *ass pre*
129. i: oui IP DA *ass ack*
130. k: mais, IP vraiment juste IP euh IP DA *fxd*
131. ya l'arrondi de la colline H IP DA *ass dr*
132. k: et euh, enfin, hum H IP DA *fxd*
133. i: ouais enfin du champ T IP DA *ass cor*
134. k: du champ U IP DA *ass ack*
135. k: et euh U IP la première ferme est vraiment euh IP juste après l'arrondi, quoi. IP DA *ass dr*
136. i: d'accord. U IP DA *ass ack*
137. k: donc, U IP le chemin quand t'as passé U euh U IP DA *fxd*
138. donc t'es passé sur le torrent IP DA *ass par*
139. i: oui T IP DA *ass ack*
140. k: tu IP passes à côté des champs inondés T IP DA *ass par*
141. i: en direction des fermes T IP DA *qyn pre*
142. k: en direction des fermes IP DA *ass qap*
143. c'est pareil, H IP DA *ass com*
144. le chemin continue T IP euh, IP à peut-être euh IP un demi-centimètre
145. à droite de la première ferme IP quoi. IP DA *ass par*
146. i: oui T IP DA *ass ack*
147. k: tu passes, U IP DA *ass psr*
148. et là, tu vas toujours tout droit IP en haut, IP à gauche. IP DA *ass psr*
149. i: oui IP DA *ass ack*
150. k: t'as une bourgade rurale T IP DA *qyn ir*
151. i: ah non, IP DA *ass qap*
152. moi, IP j'ai un hameau T IP DA *ass ir*
153. i: c'est la même chose, T IP DA *ass dr*
154. je pense T IP DA *ass com*
155. k: c'est euh, trois petites maisons T IP DA *ass dr*
156. i: oui T IP DA *ass ack*
157. k: et euh IP DA *fxd*
158. i: et est-ce que tu as un bon épicier IP à côté ? IP DA *qyn ir*
159. k: oui. IP DA *ass qap*
160. k: au dessus U enfin IP DA *fxd*
161. k: à droite, un petit peu. IP DA *ass dr*
162. i: oui, U IP à droite. U IP DA *ass ack*
163. un tout petit peu au-dessus, IP oui. IP DA *ass ack*
164. k: un petit peu au-dessus, IP ouais. T IP DA *ass ack*
165. k: donc, tu passes devant le euh, IP les trois petites maisons T IP DA *ass par*
166. i: alors je fais un... IP DA *fxd*
167. k: une fois U que t'as passé les fermes abandonnées IP ça va tout droit IP DA *ass par*
168. i: oui, je monte tout droit T IP DA *ass ack*
169. k: tout droit, oui. H IP DA *ass ack*
170. i: comme si j'allais IP entre les petites maisons IP et l'épicier IP DA *ass da*
171. k: et l'épicier IP ouais IP DA *ass ack*
172. i: oui T IP DA *ass ack*
173. k: et là IP DA *fxd*
174. i: je passe T IP entre eux T ou pas ? U IP DA *qal par*
175. k: tu passes, IP ouais, IP entre IP les petites maisons H et l'épicier IP DA *ass qap*
176. i: bon, IP d'accord. T IP DA *ass ack*

177. donc là, je suis tout en haut de ma feuille. U IP DA *ass com*
178. oui, IP DA *ass ack*
179. alors, tu vas pas U IP tout en haut tout en haut DA *ass psr*
180. k: enfin, IP si, IP parce que tu contournes euh IP l'épicier IP DA *ass cor*
181. i: d'accord. IP DA *ass ack*
182. i: je passe au-dessus. IP DA *ass ack*
183. k: donc tu tournes à droite IP DA *ass psr*
184. tu passes au-dessus, IP DA *ass psr*
185. tu vas sur la droite. U IP DA *ass psr*
186. i: sur la droite, IP oui T IP DA *ass ack*
187. k: après, IP plus bas, H IP euh, IP à peu près au milieu de la feuille
188. sur IP vers la droite IP il y a H IP un ancien hôtel IP DA *ass par*
189. i: euh non, U IP je n'ai pas l'ancien hôtel IP DA *ass rej*
190. k: t'as pas l'ancien hôtel U IP DA *ass ack*
191. i: est-ce qu'il est IP plus haut H que les torrents effroyables T IP DA *qyn dr*
192. k: oui oui, IP bien plus haut. IP DA *ass qap*
193. i: et euh IP est-ce que tu as l'océan vert T IP DA *qyn ir*
194. k: l'océan vert oui IP DA *ass qap*
195. tout à fait à droite. T IP DA *ass dr*
196. i: et alors l'hôtel T IP par rapport aux torrents et l'océan IP DA *qwh dr*
197. k: alors, IP il est IP euh U IP presque euh, IP le, le, T IP
198. la dernière dune des torrents IP DA *ass qap*
199. i: oui T IP DA *ass ack*
200. k: qui est un petit peu plus basse que IP celle d'à côté. IP DA *ass dr*
201. i: oui, IP DA *ass ack*
202. qui est arrondie. U IP DA *ass dr*
203. k: qu'est euh. IP sur la gauche, IP la dernière H sur la gauche. IP DA *ass dr*
204. i: sur la gauche. IP ah d'accord. IP DA *ass ack*
205. oui. IP DA *ass ack*
206. k: ouais IP DA *ass ack*
207. k: donc, IP l'hôtel est IP au-dessus, H IP à peu près en face, quoi. IP DA *ass dr*
208. i: et, IP à beaucoup de centimètre du pic IP ou IP DA *qyn dr*
209. k: euh IP oui, H au moins, euh IP au moins cinq, hein IP presque IP DA *ass qap*
210. i: ouais d'accord IP DA *ass ack*
211. k: il est vraiment H IP il est à peut-être à deux T centimètres de l'océan vert IP
212. quoi. IP DA *ass dr*
213. i: d'accord IP DA *ass ack*
214. k: a peu près. IP DA *ass dr*
215. i: oui T IP DA *ass ack*
216. k: donc, IP une fois U que tu as passé l'épicier IP donc, ça va en diagonale IP
217. jusqu'à l'hôtel T IP DA *ass par*
218. i: oui T IP DA *ass ack*
219. k: tu passes devant l'hôtel T IP peut-être à un centimètre euh U IP
220. en en-dessous, T IP quoi. IP DA *ass par*
221. i: en-dessous T IP DA *ass ack*
222. k: et là, H tu remontes tout droit IP DA *ass psr*
223. et le but T est juste T dans le . . . IP DA *fxd*
224. k: ça fait un petit un p- un petit endroit U IP ou ça rentre un petit peu IP DA *ass dr*
225. i: ouais, IP DA *ass ack*
226. un creux IP T DA *ass dr*
227. k: un creux IP DA *ass ack*

228. i: dans l'océan H IP oui IP DA *ass ack*
229. k: donc, IP le but H est juste H à un demi-centimetre IP
230. en petit peu plus bas, IP quoi. IP DA *ass dr*
231. i: à un demi centimètre un petit peu plus bas. IP DA *ass ack*
232. i: et là, je suis arrivée ? IP DA *qyn psr*
233. k: et là, H t'es arrivée. IP DA *ass qap*
234. i: et ben, je te remercie. IP DA *ass com*
235. j'ai essaye de ne pas me tromper. IP DA *ass com*
236. k: de rien, IP DA *ass com*
237. au revoir. IP DA *ass com*
238. i: au revoir IP T DA *ass com*

IK Annotation

1. k: euh IP est-ce que H tu pourrais m'indiquer H le chemin U H pour aller U IP
2. au bel U etang H IP DA *qyn ir*
3. i: au bel T etang U IP DA *ass ack*
4. i: euh... oui. TB IP DA *ass qap*
5. i: donc euh... IP tu IP tu T vois U les maisons H obscures T IP DA *qyn ir*
6. k: oui. IP DA *ass qap*
7. i: donc, euh, IP tu continues tout droit, T IP
8. avec les maisons obscures à ta droite. T IP DA *ass par*
9. k: oui. IP DA *ass ack*
10. i: ensuite, tu vas arriver vers le profond H etang H IP DA *ass par*
11. k: oui. T IP DA *ass ack*
12. i: tu vois ? T IP DA *qyn da*
13. i: là T tu traces une courbe T IP pour aller, DA *ass psr*
14. il y a un petit pin T IP tout à droite de la feuille T IP DA *ass ir*
15. i: je ne sais pas si tu le vois - H T IP DA *qyn da*
16. k: oui. H IP DA *ass qap*
17. i: donc tu fais comme si tu allais là, H IP DA *ass psr*
18. mais tu t'arrêtes à mi-chemin H entre le profond etang IP
19. et le petit pin H T IP DA *ass par*
20. k: um H T IP DA *ass ack*
21. i: là, IP tu vois un grand abribus T IP DA *qyn ir*
22. k: oui. T IP DA *ass qap*
23. i: oui. T IP DA *ass ack*
24. i: alors là, H tu fais un virage sur toi même T IP pour passer IP
25. sur l'arrière de l'abribus T IP DA *ass par*
26. enfin, IP pas H le contourner si tu veux, IP DA *ass psr*
27. tu passes derrière. T IP DA *ass psr*
28. k: derrière l'abribus IP DA *ass ack*
29. i: c'est clair ? T IP DA *qyn da*
30. i: ben ce qu'on voit de, U IP DA *fxd*
31. ce qu'on voit U c'est l'avant donc euh IP DA *fxd dr*
32. k: oui H IP DA *ass ack*
33. i: tu passes sur l'arrière. U T IP DA *ass psr*
34. k: ah d'accord. IP DA *ass ack*
35. i: donc ça te fait T comme un virage, IP une boucle. IP DA *ass pre*
36. k: ah d'accord. IP DA *ass ack*

37. i: voilà ! T IP DA *ass ack*
38. tu. . . IP tournes autour de l'abribus T IP DA *ass par*
39. i: un tout petit peu. T IP DA *ass pre*
40. k: oui. T IP DA *ass ack*
41. i: ça va? T IP DA *qyn da*
42. c'est bon T jusqu'à maintenant ? U T IP DA *qyn da*
43. k: jusqu'à maintenant, DA *ass ack*
44. euh oui, T IP je crois que IP ça va. T IP DA *ass qap*
45. i: euh H IP est-ce que devant toi T tu vois un verger vert U IP DA *qyn ir*
46. k: non IP je IP vois pas de verger H vert H IP DA *ass qap*
47. i: et IP est-ce que, IP un peu plus loin devant toi, IP tu vois U
48. des granges H effondrées U IP DA *qyn ir*
49. k: oui. IP DA *ass qap*
50. i: voilà. IP DA *ass ack*
51. k: euh à côté du petit pin H IP DA *ass loc*
52. i: oui, DA *ass ack*
53. il y a un autre petit pin, IP DA *ass ir*
54. mais ce n'est pas celui de tout à l'heure. IP DA *ass dr*
55. k: ah bon IP DA *ass ack*
56. parce que moi, IP l'autre, alors, IP je l'avais pas. IP DA *ass rej*
57. i: ah. T IP DA *ass ack*
58. k: mais bon T IP DA *ass com*
59. i: alors, IP on recommence. T IP DA *ass com*
60. i: euh, le premier petit pin U H IP il est T IP plus haut H
61. que les granges effondrées T IP DA *ass dr*
62. k: oui. IP DA *ass ack*
63. i: au même endroit, T IP entre les maisons obscures T
64. et le grand abribus IP DA *ass loc*
65. i: situe en hauteur si tu veux. IP DA *ass dr*
66. i: toi, T IP DA *fxd*
67. k: donc tout à fait sur la gauche. IP DA *ass loc*
68. i: tout à droite. DA *ass cor*
69. i: sur la droite IP DA *qyn da*
70. k: sur la droite. IP DA *ass qap*
71. sur la même lignes IP T que les granges effondrées U T IP DA *ass loc*
72. i: mais tu t'arrêtes H euh, H au niveau U IP entre maison obscure
73. et grand abribus IP DA *ass par*
74. k: bon, d'accord. IP DA *ass ack*
75. k: donc, ça s'appelle aussi IP DA *ass dr*
76. k: donc, U ça s'appelle aussi H euh IP DA *ass dr*
77. i: un petit pin IP DA *ass dr*
78. oui. H IP DA *ass ack*
79. k: d'accord. IP DA *ass ack*
80. i: d'accord ? T IP DA *ass ack*
81. donc euh H IP tu repars devant les maisons obscures H IP DA *ass par*
82. tu fais une H petite boucle, T IP DA *ass psr*
83. k: devant les maisons obscures T IP DA *qyn da*
84. i: ben. H IP enfin, IP tu passes H devant les maisons obscures T IP DA *ass par*
85. i: tu vas jusqu'au milieu de ta feuille, H T IP DA *ass par*
86. i: et là, H U tu fais une boucle H IP qui passe derrière l'abribus T IP DA *ass par*
87. k: et l'abribus T c'est le grand abribus T IP DA *qyn dr*

88. i: oui, T IP un grand abribus IP DA *ass qap*
89. k: et est-ce que T t'as euh IP un château du moyen-age IP DA *qyn ir*
90. i: non. IP DA *ass qap*
91. k: entre euh les maisons obscures H et IP U l'abribus IP DA *qyn dr*
92. i: non, IP pas du tout. IP DA *ass qap*
93. k: t'as rien du tout ? IP DA *ass da*
94. i: non, rien du tout. IP DA *ass ack*
95. k: donc, je passe devant les maisons obscures IP DA *ass da*
96. i: oui. T IP DA *ass ack*
97. k: je descends, T IP enfin comme si je descendais. IP DA *ass da*
98. i: tu descends T IP DA *ass ack*
99. i: tu H passes U IP DA *ass psr*
100. tu vas U comme si tu allais vers le petit pin T IP DA *ass par*
101. i: tu tournes, H IP DA *ass psr*
102. tu fais une boucle, T IP DA *ass psr*
103. k: oui DA *ass ack*
104. i: tu vas enfin H comme si tu allais vers le petit pin U
105. au milieu de la feuille H IP DA *ass par*
106. i: tu fais U demi-tour. IP DA *ass psr*
107. k: d'accord. H IP DA *ass ack*
108. i: d'accord ? H IP DA *qyn da*
109. k: hum IP DA *ass qap*
110. i: tu passes derrière l'abribus T donc, H IP DA *ass par*
111. k: je passe derrière l'abribus H IP DA *ass ack*
112. i: est-ce que tu as IP tu as le profond etang H IP DA *qyn ir*
113. k: oui, H sur la gauche. IP DA *ass qap*
114. i: oui, tout à gauche. IP DA *ass ack*
115. i: et tu as la grande plaine H IP DA *qyn ir*
116. k: non. IP DA *ass qap*
117. i: non. IP DA *ass ack*
118. bon, IP c'est pas grave. IP DA *ass com*
119. k: pas la grande plaine IP DA *ass qap*
120. i: alors IP tu tournes un petit peu autour de l'abribus U T IP DA *ass par*
121. k: oui. T IP DA *ass ack*
122. i: sur la gauche T de l'abribus T IP DA *ass pre*
123. i: hein ? T IP DA *ind da*
124. k: oui T IP DA *ass ack*
125. i: et puis H tu vas IP jusqu'aux granges U effondrées T IP DA *ass par*
126. i: mais pas, H S IP DA *fxd*
127. i: tu fais pas U un chemin droit, H IP DA *ass psr*
128. i: tu le fais un petit peu tortueux T IP jusqu'en dessous des granges T
129. effondrées IP DA *ass par*
130. i: entre les granges H effondrées U et le petit T pin IP DA *ass pre*
131. i: enfin, le deuxième petit pin IP DA *ass dr*
132. i: oui IP DA *ass ack*
133. i: voilà. T IP DA *ass ack*
134. i: euh IP tu fais une boucle autour du deuxième U petit U pin T IP DA *ass par*
135. i: c'est à dire H que tu passes par derrière DA *ass psr*
136. et tu reviens devant. T IP DA *ass psr*
137. k: mm IP T DA *ass ack*
138. i: est-ce que H tu as T une colline U IP DA *qyn ir*

139. k: non, H IP j'ai pas de colline T IP DA *ass qap*
140. i: a côté du petit pin IP DA *ind dr*
141. k: j'ai rien à U côté du petit pin H IP DA *ass qap*
142. euh, IP sauf euh H IP sur la gauche, IP enfin à peu près
143. au milieu de ma carte, U IP des vastes prairies IP DA *ass cor*
144. i: ah, IP alors H ça, les vastes prairies U
145. c'est la grande plaine IP pour moi. IP DA *ass dr*
146. k: d'accord IP DA *ass ack*
147. i: est-ce que U plus bas H que le petit pin T IP enfin plus bas que la grande plaine
148. et les vastes prairies H IP t'as un orfèvre H IP DA *qyn ir*
149. k: oui. T IP DA *ass qap*
150. i: oui. IP DA *ass ack*
151. i: alors, IP euh, H IP sur la diagonale entre l'orfèvre
152. et le petit pin U H IP DA *ass loc*
153. k: oui. IP DA *ass ack*
154. i: un peu plus proche de petit pin que de l'orfèvre H T IP DA *ass loc*
155. k: oui. T IP DA *ass ack*
156. i: tu as une colline T IP DA *ass par*
157. i: donc, tu dessines un petit euh, IP une petite montagne IP DA *ass par*
158. mais pas très haute, U IP hein ? H IP DA *ass pre*
159. k: et euh, U c'est euh IP plus près U du U petit pin donc euh. IP DA *ass dr*
160. i: oui IP plus près H DA *ass ack*
161. et plus T IP assez... IP DA *fxd*
162. i: c'est à deux centimètres au dessous du petit pin T IP et deux T
163. centimètres à gauche du petit pin quoi. H IP DA *ass dr*
164. k: d'accord. IP DA *qyn da*
165. i: d'accord ? T IP DA *ass ack*
166. k: donc, une petite colline IP DA *ass qap*
167. i: voilà. IP DA *ass ack*
168. i: donc, ton chemin passe IP devant le petit pin T IP DA *ass par*
169. k: oui. T IP DA *ass ack*
170. i: enfin, tu passes H de derrière à devant, T IP au dessus de la colline T IP DA *ass par*
171. k: donc j 'étais un peu trop loin. IP DA *ass com*
172. devant le petit pin IP DA *ass ack*
173. k: au dessus de la colline IP DA *ass ack*
174. i: au dessus de la colline U IP et là, H tu redescends H jusqu'à gauche T
175. de l'orfèvre IP DA *ass par*
176. i: de la maison de l'orfèvre IP DA *ass pre*
177. k: c'est euh tout droit ou IP DA *qyn pre*
178. i: eh oui U IP c'est pratiquement tout droit. H IP DA *ass qap*
179. k: donc, IP jusqu'à gauche. IP DA *ass pre*
180. donc, en fait je contourne aussi euh l'orf– IP DA *ass par*
181. i: tu contournes la maison IP oui. H IP DA *ass ack*
182. i: ensuite euh, IP est-ce que H tu as U une église romanesque IP DA *qyn ir*
183. k: oui. H IP DA *ass qap*
184. j'ai aussi U le tonnelier IP entre euh IP l'orfèvre H et une e IP
185. et l'église IP DA *ass dr*
186. i: donc, moi j'ai pas T le tonnelier T IP DA *ass rej*
187. mais j'ai le vignoble H IP DA *ass ir*
188. i: eh, IP ton H U ton tonnelier T IP il est IP en diagonale H
189. entre l'orfèvre et l'église T IP DA *qyn dr*

190. k: mmh, IP pas vraiment, IP DA *ass qap*
191. il est IP à la gauche de l'église H U IP DA *ass dr*
192. i: oui IP DA *ass ack*
193. k: euh assez proche, IP mais euh IP en dessous de l'orfèvre quoi, IP DA *ass dr*
194. en fait H IP en dessous de l'orfèvre IP DA *ass ack*
195. i: donc U tu passes U devant l'orfèvre U T IP DA *ass par*
196. i: tu passes au dessus du tonnelier T IP DA *ass par*
197. k: oui H IP DA *ass ack*
198. i: et tu descends entre le tonnelier et l'église H T IP DA *ass par*
199. k: d'accord IP DA *ass ack*
200. i: tu passes devant l'église T IP DA *ass par*
201. enfin en dessous de l'église romanesque IP DA *ass pre*
202. i: et là, H ton étang H IP il fait U euh IP
203. comme un pièce de puzzle, H T IP DA *ass dr*
204. k: oui T IP DA *ass ack*
205. i: avec un creux IP rentré. H IP DA *ass dr*
206. i: enfin un creux, quoi. IP DA *ass dr*
207. k: oui IP DA *ass ack*
208. k: vers le bas à droite. IP DA *ass dr*
209. i: oui vers le bas à droite. IP DA *ass ack*
210. i: et le but H est dans ce creux H T IP DA *ass ir*
211. donc tu passes devant l'église DA *ass par*
212. et tu descends un tout petit peu H IP DA *ass psr*
213. i: et tu te trouves au but IP DA *ass par*
214. k: a peu près au milieu du creux IP DA *qyn dr*
215. i: au milieu du creux IP oui. IP DA *ass qap*
216. k: d'accord. IP DA *ass ack*
217. k: donc U le but est ici. IP DA *ass dr*
218. i: j'espère que ça va. T IP DA *ass com*
219. k: voilà IP DA *ass ack*

Appendix C

Tables and figures

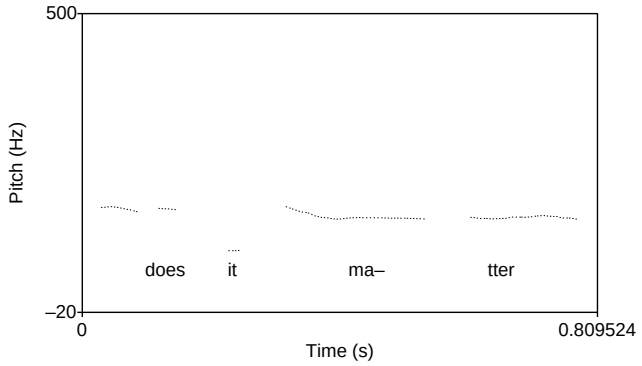


Figure C.1: A halving error on *it*.

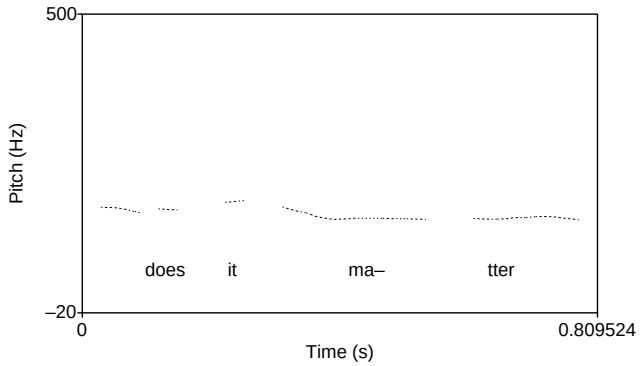


Figure C.2: The same utterance after the lower threshold for $F0$ was decreased.

Table C.1: Significant feature ranking in question identification task with 26 judges.

ID	ranking
1.	**inversion > you know > turn-final> wh-word > question test > yes/no-answer**
2.	**inversion > question test > turn-final > wh-word > yes/no-answer**
3.	**inversion | you know > yes/no-answer > turn-final > wh-word**
4.	**inversion > question test > wh-word > turn-final > you know >**
5.	**inversion > turn-final > wh-word**
6.	**inversion > you know > wh-word > turn-final > question test > yes/no-answer**
7.	**inversion > wh-word > turn-final > question test > yes/no-answer**
8.	**question test > turn-final > wh-word > you know > inversion**
9.	**wh-word > inversion > turn-final**
10.	**you know > inversion > yes/no-answer > turn-final > wh-word**
11.	**inversion > you know > turn-final > question test > wh-word > yes/no-answer**
12.	**you know > inversion > turn-final > yes/no-answer > wh-word**
13.	**question test > wh-word > inversion > turn-final > yes/no-answer**
14.	**inversion > question test > wh-word > turn-final**
15.	**inversion > you know > wh-word > turn-final**
16.	**you know > inversion > wh-word > yes/no-answer > turn-final**
17.	**inversion > turn-final > wh-word > you know > question test > yes/no-answer**
18.	**inversion > turn-final > wh-word > question test > yes/no-answer**
19.	**inversion > wh-word > turn-final**
20.	**inversion > turn-final > wh-word**
21.	**inversion > you know > turn-final > wh-word > yes/no-answer**
22.	**you know > inversion > wh-word > turn-final**
23.	**inversion > you know > turn-final > wh-word > yes/no-answer**
24.	**inversion > wh-word > turn-final > question test**
25.	**inversion > turn-final > wh-word > question test**
26.	**inversion > turn-final > wh-word > yes/no-answer**

Table C.2: The classification of polar interrogatives (a corpus study).

Type of interrogative		**Tag**		**Bias**		**GunlogsonB**	
POSITIVE	**77**	yes	4	information	4	present	2
						absent	2
				desired-state	0	present	0
						absent	0
				unclear	0	present	0
						absent	0
		no	73	information	30	present	18
						absent	12
				desired state	27	present	11
						absent	16
				unclear	16	present	8
						absent	8
NEGATIVE	**9**	yes	5	information	5	present	3
						absent	2
				desired-state	0	present	0
						absent	0
				unclear	0	present	0
						absent	0
		no	4	information	4	present	1
						absent	3
				desired state	0	present	0
						absent	0
				unclear	0	present	0
						absent	0

Table C.3: The classification of polar interrogatives (a corpus study).

positive polar interrogative	SBC	TAG	INFORMATION BIAS	DES.-STATE BIAS	UNCLEAR BIAS	GunlogsonB PRESENT	GunlogsonB ABSENT	SPEAKER
Am I doing that right so far?	9			•			•	Nathan(m)
Can I see what I did?	9			•			•	Nathan(m)
Is that why I missed it?	9			•			•	Nathan(m)
Can I use some of this?	9			•			•	Nathan(m)
Is that right?	9			•		•		Nathan(m)
Did I have anything written on the test?	9			•		•		Nathan(m)
Will it?	9			•			•	Nathan(m)
Now do you factor this?	9				•$_a$		•	Nathan(m)
Are you tired?	9				•$_c$		•	Nathan(m)
Did I get it right?	9			•			•	Nathan(m)
Is that right?	9		•			•		Kathy(f)
You can't multiply square roots like that, can you?	9	•	•				•	Kathy(f)
$\sqrt{2} \times \sqrt{3}$ *is* $\sqrt{6}$*, is it?*	9	•	•			•		Kathy(f)
Can I grow some basil?	11			•			•	Angela(f)
Does it really bother you?	11		•			•		Doris(f)
Does it come in many different forms?	12			•			•	Montoya(m)
Was there a sense of betrayal?	12			•		•		Montoya(m)
Would you say that that person has some power?	12		•			•		Montoya(m)
Am I not dealing with the racial factor of power?	12			•			•	Montoya(m)
Does recognition give you power?	12			•		•		Montoya(m)
Would you say that?	12			•			•	Montoya(m)
Is that correct?	12			•		•		Montoya(m)
Is that what we tell the world?	12		•				•	Montoya(m)
Are we less democratic?	12				•$_b$	•		Montoya(m)
Are they more democratic?	12				•$_b$	•		Montoya(m)

Table C.4: The classification of polar interrogatives (a corpus study).

positive polar interrogative	SBC	TAG	INFORMATION BIAS	DES.-STATE BIAS	UNCLEAR BIAS	GunlogsonB PRESENT	GunlogsonB ABSENT	SPEAKER
Did you know that?	13		•				•	Marci(f)
Were they going to CT at one point?	13		•				•	Wendy(f)
She doesn't have to work, does she?	13	•	•				•	Wendy(f)
Did you have any furniture yet?	13				$\bullet_a$	•		Wendy(f)
Do you like frozen yoghurt?	13				$\bullet_a$		•	Wendy(f)
Is this your hair?	13		•			•		Kevin(m)
Did you ever find out what disease you had?	403		•			•		Lenore(f)
Does George take any of this stuff?	403		•				•	Joanne(f)
Is this the season for your turtles to be romantically involved?	403				$\bullet_c$		•	Lenore(f)
Have you seen her flutter?	403				$\bullet_a$		•	Joanne(f)
Would you like a supplement?	403			•		•		Lenore(f)
Did you know that?	403		•			•		Joanne(f)
Was Nicky mad when Trace was a boy?	7		•			•		Alice(f)
Did you get grandma a tree, too?	7			•			•	Alice(f)
Does she already have one?	7			•		•		Alice(f)
Did she talk to you lately?	7		•				•	Mary(f)
Did you know Nickie wanted her own tree?	7		•			•		Mary(f)
Is he gonna take the stand?	8		•				•	June(f)
Do you know how much it's gonna be?	8			•		•		Rebecca(f)
Do you guys have the cash to pay for it right now?	8			•		•		Rebecca(f)
Do you remember the date?	8		•			•		Rebecca(f)
Have you read through your statement recently?	8		•				•	Rebecca(f)
Do you wanna read through it?	8			•			•	Rebecca(f)
Is that what you're doing?	3			•			•	Pete(m)
Is that what was going on?	3			•			•	Pete(m)

Table C.5: The classification of polar interrogatives (a corpus study).

positive polar interrogative	SBC	TAG	INFORMATION BIAS	DES.-STATE BIAS	UNCLEAR BIAS	GunlogsonB PRESENT	GunlogsonB ABSENT	SPEAKER
Do you save these things?	3			•			•	Pete(m)
So is that why you went to Africa?	3				•$_c$		•	Pete(m)
Do you guys each want like half of that?	3		•				•	Marilyn(f)
Is it grody?	3				•$_c$		•	Marilyn(f)
Do you have a salad spinner?	3		•				•	Marilyn(f)
Are they?	3		•				•	Roy(m)
Have your heard about these [. . .] developments in food lifestock?	3		•				•	Roy(m)
Is there something fishy that smells?	3		•			•		Roy(m)
Do we even want this?	3		•			•		Roy(m)
Do we want to be the guy in charge of the world?	3		•				•	Roy(m)
It's not worse than her screaming at them, is it?	2	•	•			•		Harold(m)
Do you need a partner?	2				•$_c$	•		Jamie(f)
Do they still teach at Bahia on Sunday?	2				•$_a$	•		Jamie(f)
Euh is that that?	2		•			•		Miles(m)
Is there somebody downstairs playing?	2		•			•		Miles(m)
This isn't from Africa, is it?	2		•			•		Miles(m)
Eh is there a KKSF?	2				•$_a$	•		Miles(m)
KKSF - does that mean anything to you?	2				•$_a$		•	Miles(m)
Did I tell you about that?	4		•			•		Sharon(f)
Do they have a laminating machine in the school?	4			•		•		Kathy(f)
Is that what it's called?	1		•			•		Lynne(f)
Does she have any friends do you think?	6		•			•		Lenore(f)

Table C.6: The classification of polar interrogatives (a corpus study).

positive polar interrogative	SBC	TAG	INFORMATION BIAS	DES.-STATE BIAS	UNCLEAR BIAS	GunlogsonB PRESENT	GunlogsonB ABSENT	SPEAKER
Is he staying over at Manuel Perros?	404				•$_c$	•		Charles(m)
Is that redundant?	5		•			•		Pamela(f)
Is that allowed?	5			•		•		Pamela(f)
Do we have the discharge?	14			•			•	Fred(m)
Is that attached onto a storage facility?	14				•$_c$	•		Jim(m)
negative polar interrogative								
Well I can do - find one side by doing that, can't I?	9	•	•				•	Nathan(m)
There is like a way. . . , isn't there?	9	•	•			•		Nathan(m)
Isn't that what you gave the neighbor one time?	11		•				•	Doris(f)
They only make that with NutraSweet, though, don't they?	13	•	•				•	Wendy(f)
They owe pretty much, don't they?	14	•	•			•		Jim(m)
Isn't Libya as well?	403		•			•		Joanne(f)
Mom's off, isn't she?	7	•	•			•		Alice(f)
Don't you wanna try on the men's clothes?	2		•				•	Pete(m)
On the other hand, doesn't he think it's too late?	3		•				•	Pete(m)

Table C.7: The distribution of answers across subjects in the categorization task from chapter 3 (*1 - speaker definitely expects 'no'; 2 – speaker probably expects 'no'; 3 – speaker has no expectations; 4 – speaker probably expects 'yes'; 5 – speaker definitely expects 'yes'*).

		Frequency	Percent
Valid	1.00	146	7.0
	2.00	514	24.7
	3.00	638	30.7
	4.00	603	29.0
	5.00	179	8.6
Total		2080	100.0

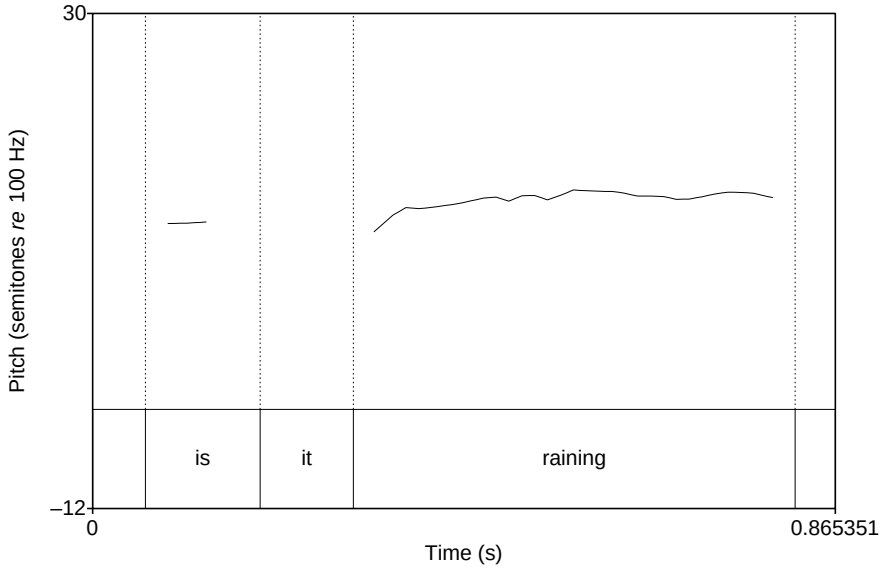


Figure C.3: A H*H-L% contour which by definition does not have the GunlogsonA feature but has the GunlogsonB property.

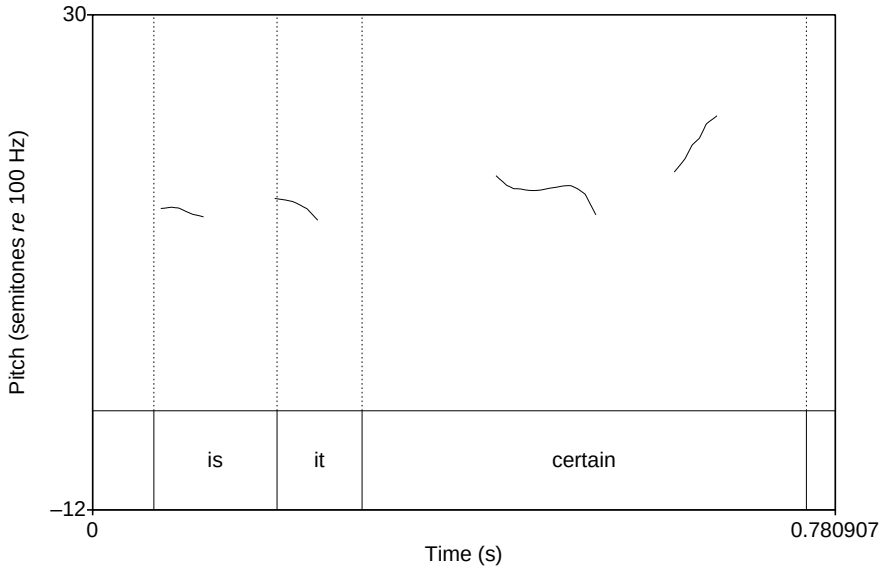


Figure C.4: A HHH contour which by definition has the GunlogsonA feature but does not have the GunlogsonB property.

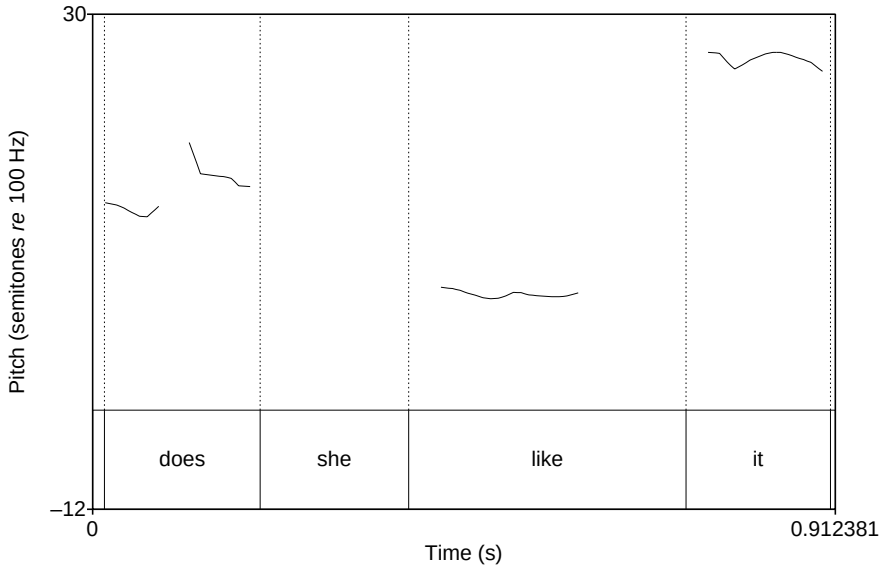


Figure C.5: A LHH contour which by definition has the GunlogsonA feature but does not have the GunlogsonB property.

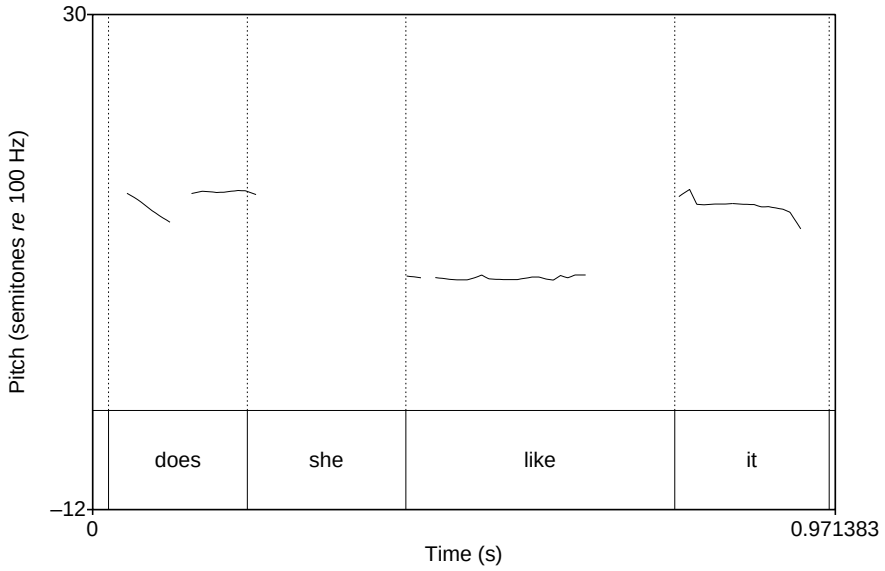


Figure C.6: A LHL contour which by definition has the GunlogsonA feature but does not have the GunlogsonB property.

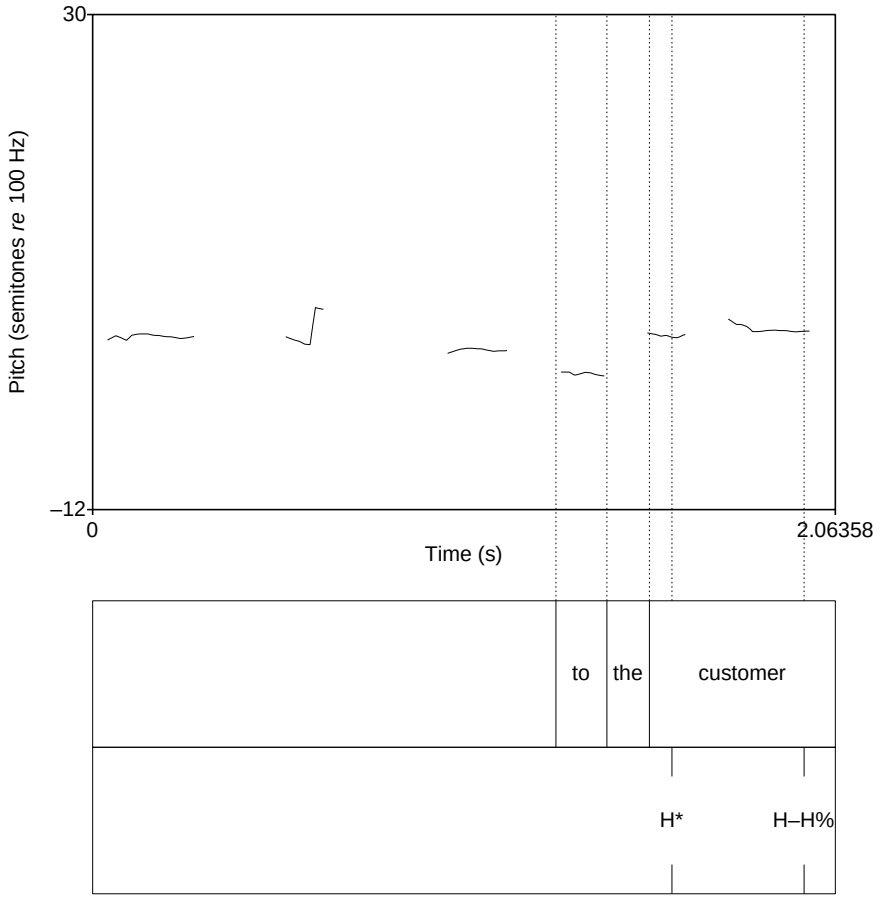


Figure C.7: A high-rising declarative.

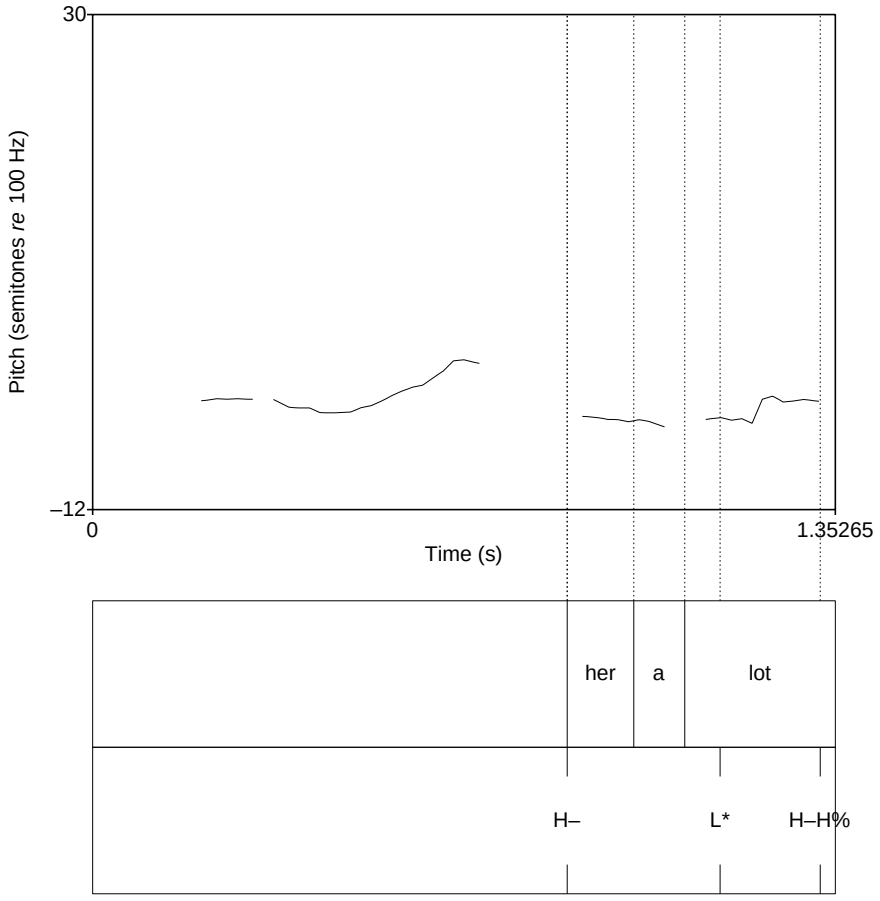


Figure C.8: A low-rising declarative.

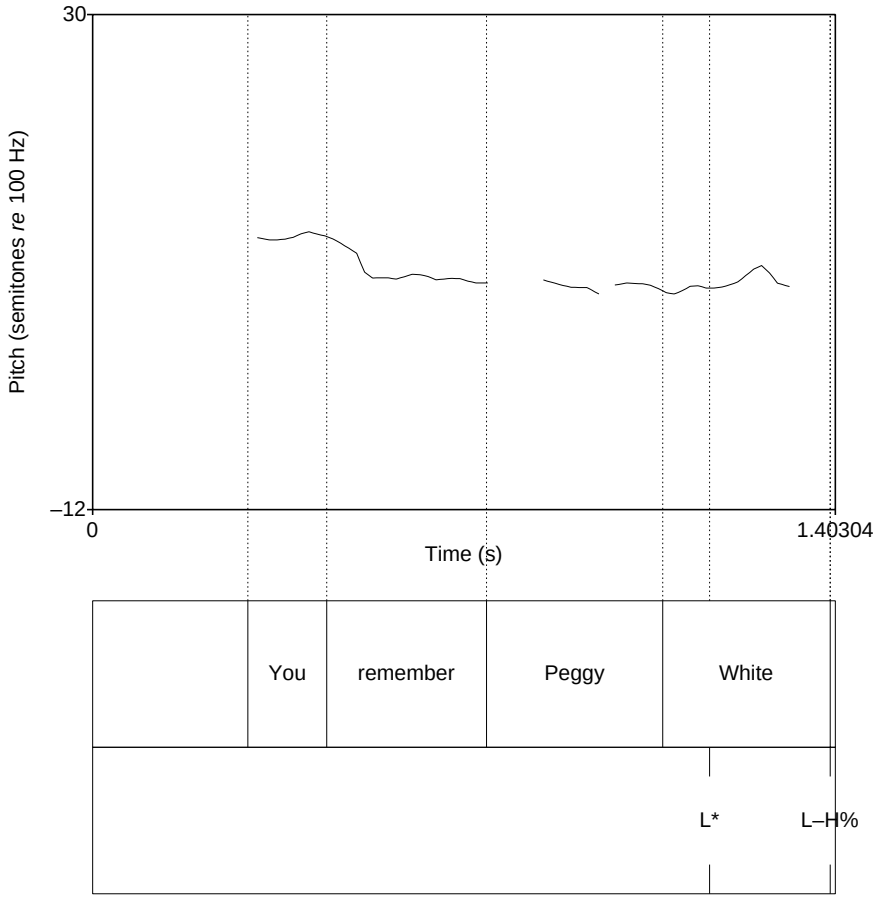


Figure C.9: A low-rising declarative with narrow range.

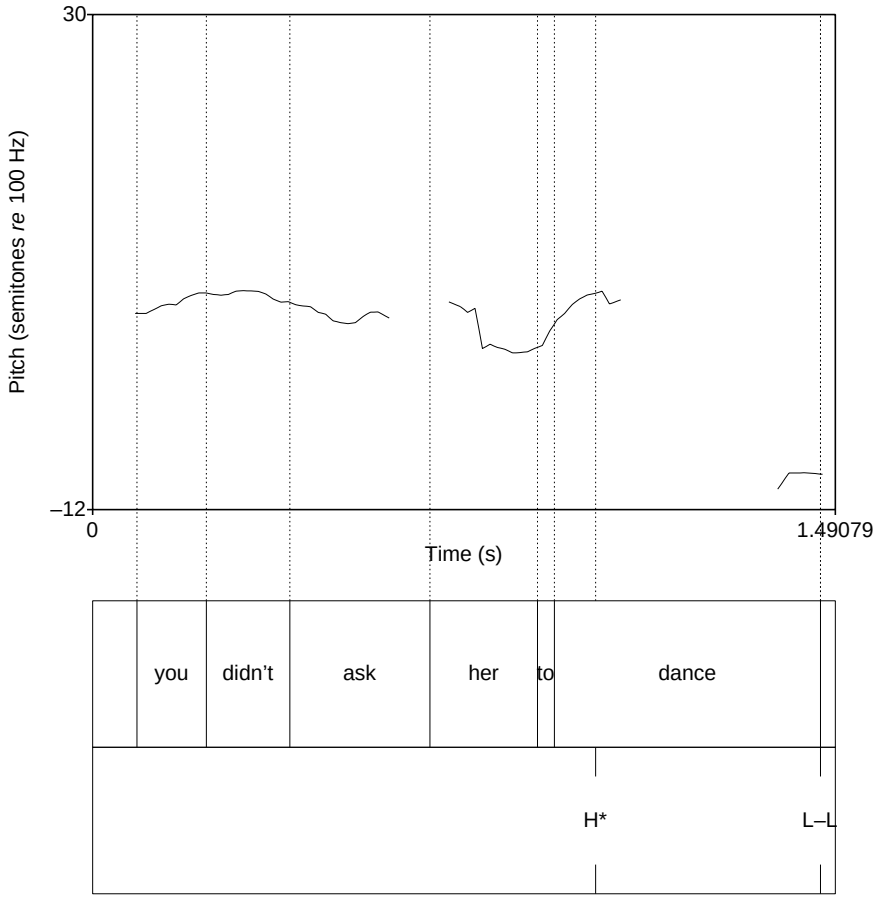


Figure C.10: A falling evaluative response-seeking declarative.

Appendix D

Decision Theory

In decision theory, an agent's belief-desire state is modeled as a tuple $\langle P, U \rangle$, where P stands for the agent's probability function, which represents her beliefs, and U for her utility function, which together with P models her preferences. The expected utility, EU of any proposition p can then be determined as:

$$EU(p) = \sum_{w \in p} P(w) \times U(w)$$

The utility of the *tautologous* proposition, $\top$, which measures the value of the current belief-desire state is:

$$EU(\top) = \sum_{w \in \top} P(w) \times U(w) = \sum_{w} P(w) \times U(w)$$

If $\langle P, U \rangle$ and $\langle P', U' \rangle$ are two different belief-desire states, $EU(P, U) > EU(P', U')$ means that the agent prefers to have the beliefs and desires in $\langle P, U \rangle$ to the beliefs and desires in $\langle P', U' \rangle$.

Two special cases of what the utility function depends on are considered in chapter 4: one, where the agent wants to know what her actual world is like (the *informational* utility/bias) and another, where the agent has the desire/goal to be in a particular world (the *desired-state* utility/bias). For the first case, which concerns the agent's beliefs, one can assume that the utility of the worlds crucially depends on the probability function P representing them. In particular, the utility of the world w is $logP(w)$ ([van Rooy, 2004]). The value of the state $\langle P, U \rangle$ then turns out to be equal to the *negative entropy* on the set of all worlds induced by probability function P. To show this, the entropy of a partition (representing a state) first has to be determined: Suppose that Q is a set of propositions that partitions the state space. The *entropy* of Q with respect to P, $E_P(Q)$, is then determined as $E_P(Q) = -\sum_{q \in Q} P(q) \times logP(q)$ ([Shannon, 1948]). This value measures the uncertainty about which element of Q is true: $E_P(Q)$ is *maximal* in case all elements of Q are equally likely, and $E_P(Q)$ is 0 – which is the *minimal*

entropy value a partition can receive – if the agent knows for certain which element of Q is the case. If we assume that W denotes the partition corresponding to the set of all worlds, the entropy of W with respect to probability function P, $E_P(W)$, is determined as $-\sum_w P(w) \times logP(w)$. Because by assumption $EU(P,U) = \sum_w P(w) \times logP(w)$, this means that $EU(P,U) = -E_P(W)$. And this makes sense as well: the entropy of partition Q measures to what extent the elements of Q are equally likely. If an agent wants to know what the world is like, she would prefer to have a probability function that gives rise to a low entropy of partition W. This, in fact, follows: because $EU(P,U) = -E_P(W)$, this value is high if and only if $E_P(W)$ is low.

For the second case of utility function considered here – the desire to be in a world where g is true, or the goal to make that world actual where g is true – the utility function is simply defined as follows:

$$U(w) = 1 \quad \text{iff} \quad w \in g, \quad 0 \text{ otherwise}$$

Now the value $EU(P,U)$ reduces to the probability of g, $P(g)$: $EU(P,U) = \sum_w P(w) \times U(w) = \sum_w P(w) \times 1$, if $w \notin g, 0$ else $= \sum_{w \in g} P(w) = P(g)$.

As for what the value of learning that a proposition q is true would be in agent's current belief-desire state, in decision theory, it is standard to measure the value of new information in terms of the *difference* between the values of the information states before and after the agent learned proposition q. Let us assume that learning proposition q goes by conditionalization – eliminating all worlds where q is not true, the probabilities among the resulting worlds being distributed as similar as possible as in the prior probability function. Let us denote the probability function after conditionalizing P with q by P_q, and thus assume that $P_q(w) = P(w/q)$. The value of new information q, $UV(q)$ can then be measured as follows:

$$UV(q) \quad = \quad EU(P_q, U) - EU(P, U)$$

For information utility, since the value of a state, $EU(P,U)$, reduces to the negative entropy of the partition W, $-E_P(W)$, it follows that the utility value of the new information q reduces to the difference between $-E_{P_q}(W)$ and $-E_P(W)$, i.e. $UV(q) = -E_{P_q}(W) - -E_P(W)$. This is actually the same as the reduction of entropy of W due to learning q, $E_P(W) - E_{P_q}(W)$. In natural circumstances, this, in turn, reduces to the *surprisal value* of q, $\inf(q) = -logP(q)$, a measure well-known in Information Theory (viz. [Shannon, 1948]). The surprisal value is defined such that for any two propositions q and q', $\inf(q) > \inf(q')$ if and only if $P(q) < P(q')$. In other words, learning the proposition q will be more useful than learning the proposition q' to an agent, if the probability of q (in her belief state) is lower than the probability of q'. For desired-state utility, the utility function only depends on the goal proposition p. The expected utility of a proposition p, $EU(p) = \sum_{w \in p} P(w) \times U(w)$ and $EU(P,U)$ thus here reduces to $P(p)$. Then the

value of new information q reduces to the difference between $P(p/q)$ and $P(p)$, i.e. $UV(q) = P(p/q) - P(p)$.

To sum up, in case an agent wants to know what the world is like, it holds that $UV(q) > UV(\neg q)$ if and only if $P(q) < P(\neg q)$. If she has a goal g to be(come) true, it holds that $UV(q) > UV(\neg q)$ if and only if $P(g/q) > P(g/\neg q)$ if and only if $P(g/q) > \frac{1}{2}$ (the probability of reaching her goal after finding out that q is higher than after finding out that $\neg q$, i.e., higher than $\frac{1}{2}$). These facts can be used to account for speaker's choice of a particular polar question. In particular, the proposal used in chapter 4 is based on the assumption that the speaker prefers to ask that type of polar question for which the utility of the positive answer is higher than that of the answer with an opposite polarity:

$$UV(q) > UV(\neg q)$$

The two cases distinguished here can be described as:

1. $UV(q) > UV(\neg q)$ (where $UV(q) = inf(q) = log\frac{1}{P(q)}$) because the information value of the proposition q is higher than the information value of its negation.

2. $UV(q) > UV(\neg q)$ because $P(g/q) > P(g/\neg q)$, i.e., after learning the proposition q it is more likely that one reaches a desirable g-world than when its negation is true.

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Samenvatting

Dit proefschrift bestudeert de betekenis en het gebruik van stijgende intonatie in het Engels en Frans. Het centrale thema kwam voort uit de algemeen geaccepteerde stelling dat er een karakteristieke vraag melodie in het Amerikaans-Engels bestaat. Maar de term ‘ vraag’ (in tegenstelling tot ‘interrogatief’) bleek problematisch omdat sprekers hem op verschillende manieren interpreteren. Een extreme interpretatie is als taaluiting die een antwoord nodig heeft (deze interpretatie bevat dus imperatieven en vragen om een teken van *acknowledgment*). Een andere extreme interpretatie is als zinnen met interrogatieve tekens. Deze bevinding ondermijnt reeds bestaande conclusies wat betreft de interpretatie van bepaalde contouren als ‘vragen’. In dit proefschrift wordt in plaats daarvan een pragmatische definitie van vraaguitingen toegepast, gebaseerd op de kenmerkende functie van een interrogatief, namelijk het vragen om een evaluatief antwoord. Een aantal criteria worden geintroduceerd om in een gesprek uitingen die een evaluatief antwoord vragen te identificeren. Experimenteel onderzoek laat zien dat proefpersonen ook buiten de context declaratieve zinnen die om evaluatieve antwoorden vragen kunnen identificeren. Verder is er ook een verzameling contouren die de interpretatie faciliteren (ondanks het feit dat hun aanwezigheid noch noodzakelijk en evenmin voldoende is). Deze contouren kunnen het meest eenvoudig worden beschreven met behulp van Gunlogson’s definitie van ‘final rise’. In dit proefschrift worden ze beschreven met de brede ToBI notatie als de nucleaire L*H-H%, H*H-H% en L*L-H%. Het blijkt dat deze drie contouren de om een evaluatief antwoord vragende interpretatie beter voorspellen dan andere eigenschappen van de taaluiting (bijvoorbeeld de aanwezigheid van een heterocognitief predikaat, die in andere omstandigheden ook aan deze specifieke interpretatie verbonden is). Tenminste in deze zin is dus de betekenis van intonatie in geen opzicht zwakker dan de betekenis van woorden.

Vervolgens onderzoek ik in dit proefschrift stijgende en vallende interrogatieve zinnen in het Amerikaans-Engels in hun gebruikscontext. Volgens reeds bestaande studies neigen vallende interrogatieve zinnen naar een positief antwoord in som-

mige contexten en naar een negatief antwoord in andere contexten. Deze discrepantie kan worden geanalyseerd door een beslistheoretische verklaring van het gebruik van polaire interrogatieve zinnen. Deze verklaring baseert op twee verschillende bias gevallen: een waarbij de spreker graag wil dat de bewering van dezelfde polariteit waar is, en een tweede waarin zij verwacht dat de bewering met de tegenovergestelde polariteit klopt (in beide gevallen leidt een affirmatief antwoord tot een hogere utiliteit dan een negatief antwoord). De beslistheoretische beschrijving kan echter niet alle data verklaren. Deze observatie werd verder bevestigd door een *perceptual categorization task* die werd ontworpen om de samenhang tussen nucleaire melodie en het bias type te toetsen. Uit dit onderzoek bleek dat stijgende nucleaire melodie vaak geassocieerd wordt met de wens van de spreker dat het affirmatief antwoord waar is (*desired state bias*), warentegen de niet stijgende nucleaire melodie geassocieerd wordt met de informationele bias van de spreker naar een negatief antwoord.

Deze empirische observaties wat betreft het gebruik van stijgende intonatie in declaratieve en interrogatieve zinnen werden gekoppeld aan een formalisering in de *update semantics*. Hierbij exploiteren wij de suppositie dat de taalwetenschappelijke hoofdinterpretatie van de stijgende nucleaire melodie *onzekerheid* (en niet vragen) is. In termen van de universele biologische codes voor toonhoogte interpretatie hebben wij hun linguïstieke en paralinguïstieke adaptatie dus uniform gehandhaafd; het vaak voorkomend vraageffect van stijgende declaratieve zinnen in een context werd afgeleid uit de maximes voor rationele conversatie. Dit voorstel gebruikt geen hybride categorie vraag/stijgende declaratieve zin maar het behandelt deze uitingen gewoon als declaratieve zinnen die een epistemische onzekerheidsoperator bevatten (namelijk de stijgende nucleaire melodie). Deze aanpak kan zowel het gebruik van stijgende taaluitingen (declaratieve en interrogatieve) in contexten verklaren die problematisch waren voor reeds bestaande theorieën, als ook de verbinding tussen beleefdheid en stijgende taaluitingen algemeen.

Tenslotte rapporteren wij ook enkele preliminaire resultaten wat betreft stijgende nucleaire melodie in het Frans. In twee corpus studies vonden wij een significante relatie tussen deze melodie (uitgedrukt met behulp van de INTSINT notatie) en polaire vragen, maar ook *discourse topic openings*. De verbinding tussen stijgende melodie en *topic openings* was sterker dan de verbinding met vragen (dit suggereert het werken van de *Effort Code*), maar er was geen herkenbaar patroon om stijgende melodie bij vragen met *topic openings* te gebruiken. Hier was de conclusie dat er een gedetailleerder systeem voor intonatie transcriptie nodig is om deze vragen verder te onderzoeken.

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