A Game-theoretical Approach to the Meaning of Intonation in Rising Declaratives and Negative Polar Questions

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Abstract

On a closed set of English data, consisting of rising declaratives and outer-negation polar questions, we show some advantages of a pragmatic game-theoretical approach to the analysis of intonation, in particular an End Rise.

1. Introduction

Determining the meaning of intonation is notoriously difficult. On one hand, [1] claims that its contribution is emotional, rather than informational: "...even when it interacts with such highly conventionalized areas as morphology and syntax, intonation manages to do what it does by continuing to be what it is, primarily a symptom of how we feel about what we say, or how we feel *when* we say it" ([1]:1). On the other hand, there is the popular discourse-epistemic approach of, e.g., [16], in which particular tone and boundary combinations are related to information status and updates in the discourse. It seems that a game-theoretical approach to the meaning of intonation can potentically satisfy the proponents of both perspectives, in that it concerns both the epistemic states of the the conversation participants, as well as their interactional goals situated in a particular social setting. In our contribution, we will primarily focus on the second aspect of the semantics and pragmatics of intonation.

2. Some Previous Approaches

[12] show on a number of examples the inadequacy of the discourse-epistemic approach to the meaning of intonation [16]. They propose (for English) that the core meaning of intonational morphemes (falls, rises and their compounds) of focussed elements be expressed in terms of allocation of the *dominance-parameter* (viz below) in a speech act. Their approach is based on [11], a game-theoretical description of a conversation as a bargaining game [13].[1] In the game, the players are concerned with establishing the content of their common ground [19], reconciling their preferences. Each state in the game can be described with four parameters, with the value 'Speaker' or 'Addressee' - **actor-role** [S], **preference** [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. [11] makes the assumption that preference is strict and converse, i.e., if one agent prefers Θ, the other agent prefers ¬Θ. Note that having a preference for Θ does not necessarily mean having the belief that Θ is true (although 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, a.o., by [7]). Roughly, in the specific setting of conversations, an agent A would dominate (have power over) another agent B with respect to a proposition p, if A dominates B socially, and/or if the utility of adopting p is higher for B than not adopting p. This can be either direct, or indirect, when not adopting p would mean (not) adopting other propositions with total loss of utility. In many settings, dominance can be related to the reliability of the source of information (well-informedness and credibility of agents, viz [3]).

[11] considers only the four types of states in which [P]=[I]: CLAIM <S,S,S,S,Θ>, CONCESSION <S,A,A,A,Θ>, DENIAL <S,A,S,A,Θ> and RETRACTION <S,S,A,S,Θ> (but in principle there is no reason why other types could not occur as well, viz below). For intonation, [12] propose that Rise (L*H@) alienates dominance to the hearer, while a Fall (H*L@) appropriates it (where @ stands for one of the stress- or position-related features {*,-,%}). By giving up dominance, the hearer also fails to assert the proposition contained in her utterance (see [12] for detailed discussion, especially concerning wh-questions).

However, it seems that [12]'s proposal is too strong, in view of examples such as '*William isn't drinking because he's L* unhappy H- but because he's an alcoholic*' where the (L*)H- indicates a discourse dependency between the first and the second clause, rather than dominance allocation. Also given the existence of pitch accent languages, a pragmatic interpretation of all instantiations of L*H@ seems less plausible. On the other hand, boundary tones appear to be quite uniformly used across languages [18] (though exceptions can be found, such as Belfast English or Chickasaw, [5]). Therefore, we will relate the dominance-parameter allocation only to high pitch boundary tones (see [5] for experimental data concerning the language invariant perception of the end pitch).[2]

It is well known that high end pitch has been related to gender differences in language use. [10] and [15] subsumes other features associated with the sound under the biologically determined Frequency Code. The notion of dominance as a decision-theoretic concept thus straightforwardly expresses the sociolinguistic effects of the Frequency Code.

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[1] In pragmatics, game theory (and decision theory) has proven to be fruitful in the past as a formalism for describing interaction among communicating rational agents (viz the work of P. Gmytrasiewicz, A. Merin and R. van Rooy, a.o.).

[2] In fact, for the time being we will focus on two contours, L*HH% and H*HH%, viz below.

We will show that if we adopt the game-theoretical proposal of [12], we can account for two sets of English data which have until now appeared problematic.

3. Data

3.1. Rising Declaratives

Rising declaratives (RDs) in English are syntactic *declaratives* with the ri   is.


that's your new car
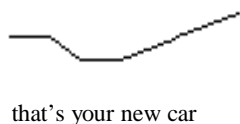
On the other hand, they differ from both declaratives and polar questions in their context requirements. Unlike declaratives, they fail to commit the speaker to their propositional content, and unlike polar questions, they do not support polarity items like *any* or *ever*, and they are not appropriate if the speaker is supposed to be ignorant and/or unbiased. [5] suggests to capture these requirements by the 'Contextual Bias Condition': RISING DECLARATIVES CAN ONLY BE USED AS QUESTIONS IN CONTEXTS WHERE THE ADDRESSEE IS ALREADY PUBLICLY COMMITTED TO THE PROPOSITION EXPRESSED. However, it is possible to find counterexamples to the condition ((ii) and (iii) from [5]):

> (i) (At Tim's graduation, Tim is standing next to a woman in her sixties.) Jack: "**You are Tim's mother?**"
> (ii) Radio station DJ: "Good morning Susan. Where are you calling from?" Caller: "**I'm from Skokie?**"
> (iii) Waiter (to customer): "**My name is Carl? I'll be your waiter tonight?**"

In none of these examples is the addressee publicly committed to the proposition expressed by the RD: in (i), it is based on the speaker's guess and in (ii) and (iii), the speaker uses a RD to express a proposition which is her private knowledge, with the rising contour indicating lack of dominance.

Figure 1.: Informative rising declarative with L*HH contour
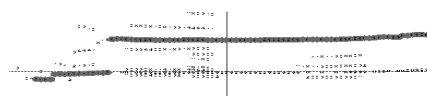
Interestingly, [4] identifies the relevant contour to be of any of the following types: H*HH%, L*HH%, L*LH% and L*HL%, while [8] argue for a distinction between L*HH% and H*HH%. According to [8], the high-rise (H*HH%) is used for informative rising declaratives of the type (ii), while the *yes-no* question contour *proper* appears in the uninformative rising declaratives which fit into [4]'s theory. In the Santa Barbara Corpus of spoken English, we have found all four patterns, i.e., informative RDs with L*HH (as in SBC0001.wav 159.56-161.21 " % *and then you can see this little white line* L*HH%", viz *Figure 1.*) and H*HH contour and uninformative RDs with L*HH and H*HH contour (as in

SBC0001.wav 352.07-355.62 "*every horseshoe is custom-made for the horse then* H*HH%"). For the time being, we will, therefore, take as relevant for our analysis these four contours, leaving aside for future research the remaining patterns (as well as the issue of uptalk).

To summarize the main point made in this section, the meaning of rising declaratives cannot be accounted for simply in terms of addressee's commitments, but rather in terms of dominance (either social, or based on informedness of agents).

3.2. Negative Polar Questions

As observed by [9], there are two types of negative polar questions (PQs) – **outer negation** PQs (ONPQs) and **inner negation** PQs (INPQs), which differ pragmatically and morphosyntactically. E.g., in German: *Gibt est **nicht ein** vegetarisches Restaurant in dieser Ecke?* (ONPQ) vs. *Gibt es **kein** vegetarisches Restaurant in dieser Ecke?* (INPQ) would, *ceteris paribus*, both be translated as 'Isn't there a vegetarian restaurant around here?' but in the first case, the speaker expects a confirmation of the proposition 'there is a vegetarian restaurant around here', while in the second, she is asking for a confirmation of the proposition 'there is no vegetarian restaurant around here' [2]. Intuitively, a speaker would use the ONPQ, rather than a positive polar question (*Is there a vegetarian restaurant around here?*) because she has some private evidence that the proposition expressed by the question is true. This is even more obvious in ONPQs with falling intonations (*Didn't I say so*). In other words, ONPQs express a positive proposition (rather than a negative one, which would explain why they do not support negative polarity items, as observed by [2]).

Like RDs, ONPQs are thus used in situations where the speaker wants to express a certain proposition without becoming publicly committed to its truth. On the other hand, RDs can be used as acknowledgement questions (A: *I'm a communist. –* B: *You're a communist?*), while ONPQs cannot be used in a context where the addressee is already publicly committed to the proposition they contain (A: *I'm a communist.* - B: *#Aren't you a communist?*).

4. Analysis

3.1 Rising declaratives

Extending [11]'s typology of speech acts, we propose that rising declaratives are of a fifth type, namely $<S,A,A,S,\Theta>$. Starting from the right, the game of whether a proposition Θ will become a part of the common ground is initiated by the speaker, dominance (i.e., whether speaker's or addressee's preference dominates) is allocated to the addressee, as well as the preference for Θ. This description captures [4]'s observation that RDs are often used in situations in which the addressee is expected by the speaker to be committed to the truth of Θ (the preference is hers). Note that the ability to force the commitment (=dominance) is addressee's as well, either because the speaker lacks necessary information in support of Θ, or because she gives up the dominance to the addressee as a signal of politeness (or submissiveness). In (ii) and (iii), the speaker was ignorant with respect to the issue expressed by the RD, but in this case, speaker's preference is not strictly opposed to that of the addressee (again, preference for a proposition p is not equal to knowledge that p).

4.2. Polar questions

According to [12], positive polar questions are usually of the type <S,A,A,A, Θ>, i.e., concessions. Straightforwardly, we describe inner-negation polar questions as <S,A,A,A, ¬Θ>, where the proposition under discussion is the negation of the proposition expressed in positive PQs. For ONPQs with *falling* intonation, we propose a sixth type of a social act, namely <S,A,S,S,Θ>: the initiative for a game about Θ is again speaker's, the ability to force Θ is hers as well (falling contour), but the verb inversion indicates that the preference for Θ is addressee's (for politeness reasons, speaker shows preference for ¬Θ, or expresses a presupposition that the addressee prefers Θ, which, given that preference is strictly converse, amounts to the same). Analyzing the negation in ONPQs in terms of preference-reversal (comparable to the treatment of negation in game-theoretical semantics, viz [7]) accounts for the observation that "the negation is somehow 'outside' [the] proposition, hence unable to license [negative polarity items]" [2]: the role of the outer negation is purely pragmatic.

ONPQs with *rising* intonation also occur: in this cases, we propose to describe them as <S,A,A,S,Θ>, with the change in contour corresponding to change in dominance allocation; they are thus the same type of social act as RDs. As noted above, there is, however, one crucial difference between RDs and ONPQs in that ONPQs cannot be used in contexts where the addressee is already publicly committed to the proposition expressed by the act. Obviously, the difference has to be accounted for by explaining the role of negation in ONPQs: a speaker uses the outer negation to indicate preference reversal, but this is irrelevant in a conversation situation where the addressee has already clearly indicated what her preference is. Note that informativity is not at stake since in this case, RDs are uninformative as well (the addressee just stated the proposition) and only trigger the epistemic implicature that speaker previously did not expect the proposition in RD to be true [17] or serve as an acknowledgement act [14].

5. Summary and discussion

To sum up, we use an extension of [11]'s typology of social acts in order to describe the meaning of rising declaratives and negative polar questions in English.

Table 1: Types of communicative acts

Type	S	P	D	I	
Claim,wh-questions	S	S	S	S	Θ
Concession, positive PQs[1]	S	A	A	A	Θ
Denial	S	A	S	A	Θ
Retraction	S	S	A	S	Θ
Rising declaratives and ONPQs	S	A	A	S	Θ
Falling ONPQs	S	A	S	S	Θ
?	S	S	S	A	Θ
?	S	S	A	A	Θ

[1] Inner-negation PQs would be of the same type, only the proposition under discussion would be ¬Θ.

We can account for the meaning of a rising contour in declaratives and its relation to lack of social or informedness dominance. We have linked the use of negation in ONPQs with preference-reversal and thus explained the fact that in ONPQ-acts, a speaker expresses a positive proposition (rather than a negative one) and that for reasons of relevance, ONPQs (unlike RDs) cannot be used in contexts where it is already publicly known that the addressee prefers the positive proposition.

We have extended [11]'s typology with two additional types. As shown in *Table 1*, logically there are two other types possible but at this point we can only speculate on which kind of acts would represent them in natural language exchanges.

In order to capture some contextual restrictions on possible moves in a dialogue, [11] proposes a labelled transition system (in which, e.g., claims can be immediately followed by denials or concessions, but not retractions). Since we have enlarged the original typology with at least two additional types, the transition system has to be changed accordingly. Although the resulting system will necessarily be quite complex, specifying its design is desirable not only for theoretical but also for practical purposes. In particular, the scheme can be used as the core engine of a dialogue system (serving human-computer natural-language based interaction) because it contains either directly or indirectly the basic information needed by the dialogue system to plan appropriate future moves (via preference) and to distinguish between information provided by the user and the information coming from its own knowledge base (via dominance). What is lacking is a clear relation between the types of acts and a broader context (the labeled transition system only considers the immediately preceding move). Further research into the issue is needed also for an account of the meaning of intonation. A complete theory has to combine a purely discourse-epistemic approach with a game-theoretic one advocated in the present work (where roles of agents, there conversation goals and powers are taken into consideration).

6. References

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