Intonation and Discourse: Biased Questions[*]

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This paper surveys a range of constructions in which prosody affects discourse function and discourse structure. We discuss English tag questions, negative polar questions, and what we call "focus" questions. We postulate that these question types are complex speech acts and outline an analysis in Segmented Discourse Representation Theory (SDRT) to account for the interactions between prosody and discourse.

Keywords: Bias, Intonation, Prosody, Complex Speech Acts, Negative Polar Questions, Tag Questions, SDRT

1 Introduction

As semanticists have repeatedly demonstrated over the past twenty years, intonation often conveys information important for determining the content of a discourse. Intonation is important for marking focus, which in turn is important for interpreting sentences with focus sensitive adverbs like *even* and *only*. Intonation is also important in marking the discourse function of utterances in discourse and dialogue. For example, intonation is an essential clue in determining whether an assertion can function as an answer to a question given in prior discourse. The canonical way of presenting an answer to a question such as (1-a) is to place the nuclear pitch accent on the constituent that replaces the *wh*-particle, as in (1-b). Alternative realizations of the same sentence are anomalous, as shown in (1-c).

(1)   a.   A: Who loves Mary?

       b.   B: [Jackie]$_F$ loves Mary

       c.   B: #Jackie loves [Mary]$_F$

Asher (1995) and Txurruka (1997) investigate similar intonational cues to discourse relations in detail within the formal theory of discourse interpretation known as Segmented Discourse Representation Theory or SDRT, and many others have investigated the topic in other frameworks (Ward and Hirschberg 1985, Pierrehumbert and Hirschberg 1990, Büring 2003, a.o.).

The present paper explores another way in which intonation contributes to conveyed content. Sometimes in a discourse or dialogue a single locutionary act corresponds to two (or more) illocutionary acts. Furthermore, these illocutionary acts are ordinarily conveyed by utterances with incompatible semantic types (Asher and Lascarides 2001). We refer to such locutions as *complex speech acts*. Indirect requests, as in (2-a), are a prime example (Searle 1975).

(2)   a.   Could you *please* pass the salt?

       b.   Do you (#*please*) speak Arabic?

(2-a) is syntactically an interrogative, and therefore – by the conventional association of clause type and discourse function – asks a question. We also have independent evidence that (2-a) asks a question, since one can reply *yes* to (2-a) and to (2-b), but not to direct requests like (3):

(3)   Pass the salt

Nevertheless, (2-a) also functions as a request; the adverb *please* in (2-a), which marks polite *requests*, does not normally occur in neutral questions, as shown by (2-b).

Indirect requests are not the only kind of complex speech act. In this paper, we discuss a range of interrogative sentences which we argue function as both *questions* and *assertions*, and in which prosody – intonational phrasing, intonation, stress – often has important interpretive effects. We refer to these constructions as *biased questions*, as they convey an expectation, or bias, on the part of the speaker toward a specific answer to the question. We show in §3 that biased questions convey an assertion.

Examples of the types of interrogatives that we investigate are provided in (4) – (6). Tag questions, as in (4), provide a natural starting point, as they wear their illocutionary force(s) on their sleeves, so to speak.

(4)   a.   Jane isn't coming, is she?
        b.   Jane is coming, isn't she?

As a matter of clausal syntax, tag questions possess both declarative and interrogative components. It is not unexpected, then, that they have properties of both assertions and questions. However, a number of more nuanced issues arise regarding their interpretation. First, tag questions are not always biased. Second, the discourse function of the interrogative component is influenced by the final pitch movement over the tag.

Negative polar questions as in (5) are also biased toward a specific answer (Ladd 1981, van Rooy and Šafářová 2003, Romero and Han 2004, Reese 2006a).

(5)   a.   Isn't Jane coming *too*?
        b.   Isn't Jane coming *either*?

We argue below that on the so-called "outside-negation" reading in (5-a) (cf. Ladd 1981) negative polar questions do consist, at least in part, of an assertion. We link the biased reading of negative polar questions to the neutral reading

of tag questions and discuss the weaker form of bias present on the so-called "inside-negation" reading, (5-b).

Finally, the examples in (6) each convey a bias toward a negative answer. Since Borkin (1971), negative bias has been linked to the presence of a strong negative polarity item (NPI) (cf. Ladusaw 1979, Krifka 1995, van Rooy 2003, Guerzoni 2004, also).

(6) a. Did John *lift a finger* to help Mary?
    b. Is John EVER going to help Mary?
    c. Did I TELL you writing a dissertation would be easy?

But it also occurs when a weak NPI like *any* or *ever* is pronounced with emphatic stress, as in (6-b), and in certain examples of narrow focus, as in (6-c) from Sadock (1971). As far as we know, the examples in (6) have not received a unified account (see Asher and Reese (2005) for a recent attempt). It seems to us that such an account is desirable and we attempt to provide one here.

In broad terms, our account of bias is couched in a theory of the alignment of linguistic form and illocutionary force. That is, our account of biased questions is framed within a linguistic theory of speech acts, as supplied by SDRT. Many aspects of linguistic form contribute to the determination of discourse function, including:

- clausal syntax and semantics,

- specific lexical choices,

- phonology

We are interested, in particular, in how phonology interacts with lexical and compositional semantics to influence the rhetorical role an utterance plays in a discourse or dialogue. Aspects of phonology relevant to interpretation include

final tune and nuclear pitch accent (or focus). The former is normally taken to signal some relation between the speaker, the underlying propositional content of an utterance and the common ground or the public commitments of various discourse participants (Gussenhoven 1984, Steedman 2000, Gunlogson 2003, Marandin et al. 2005). The latter contributes information structural information, for example by marking information as given or new, in addition to introducing a set of alternative propositions.

We provide a formal model of complex speech acts using an extension of type theory proposed in Asher and Pustejovsky (2004) and a theory of discourse interpretation, viz. SDRT. SDRT distinguishes many relational types of speech act (like answers) and provides a good framework for analyzing complex speech acts. In particular, it distinguishes a number of types of questions that will prove useful here. For example, while many people have recognized that there are speech acts like acknowledgements that are a subspecies of assertions, SDRT postulates that for each such type of speech act, there is a corresponding question form—a question whose goal is to elicit an acknowledgement from the other discourse participants. We provide an analysis of the constructions in (4) – (6), focusing on the interaction of intonation, prosody and syntax, in the promotion of bias and the computation of the rhetorical role of complex speech acts.

2 Kinds of Biased Questions

The present section offers more detail on the constructions introduced in §1.

2.1 Tag Questions

Although English tag questions have received a lot of attention in descriptive grammars of English (Quirk et al. 1985, Huddleston and Pullum 2002) and from syntacticians (Culicover 1992), there has been relatively little *formal* semantic

and pragmatic work, and certainly little or no *recent* work.[1] Nevertheless, tag questions provide an interesting case in which intonation contributes to what is said.

Syntactically, tag questions consist of a declarative clause paratactically related to a reduced interrogative clause, or *tag*, as in (4) from §1. While these surface syntactic features certainly contribute to the presence of both an assertion and a question in discourse logical form, (i) they do not *guarantee* it, and (ii) they do not provide any information about the specific rhetorical contribution of the tag.[2] We maintain that certain lexical and phonological cues provide information for the computation of more fine-grained discourse functions.

We assume the model of intonational tunes assumed by the To(nes) and B(reak) I(ndices) labelling conventions (Beckman and Elam 1997). In ToBI, intonational tunes consist of strings of tones constructed on the basis of a simple generative grammar. An intonational phrase consists of one or more intermediate phrases followed by a boundary tone, L% or H%, and an intermediate phrase consists of one or more pitch accents followed by a phrase accent L- or H-. ToBI assumes five pitch accents: L*, H*, L+H*, L*+H, H*+!H. Pitch accents are tones aligned with stressed syllables. Given this background, there are two phonological distinctions relevant to the understanding the meaning and use of tag questions.

First, the sequence of phrase accent and boundary tone, i.e. final falling vs. final rising intonation, on the tag has been claimed to have important interpretive effects (cf. Rando 1980, Quirk et al. 1985, Huddleston and Pullum 2002, a.o.).[3] Most, if not all, descriptions of tag questions note this fact and associate

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[1]   Older treatments of the semantics and pragmatics of tag questions include Sadock (1974), Millar and Brown (1979), Rando (1980), Ladd (1981).

[2]   The most one could claim is that the presence of the assertion blocks the default communicative goal associated with questions, viz. to know an answer.

[3]   It is an empirical question about how best to characterize the final vs. rise distinction. For example, Gunlogson (2003) distinguishes between falling vs. non-falling. As a result, she includes final plateaus, i.e. H-L% sequences, with rises. We ignore these issues here and

some interpretation with the fall vs. rise distinction. Descriptions of these interpretations are remarkably consistent between researchers and we have no reason to dispute them here. Tag questions with falling intonation ask for acknowledgment from the addressee that the communicative goal of the anchor has been achieved, cf. Huddleston and Pullum (2002) for example. In SDRT, this communicative goal is called a *speech-act related goal*, or SARG and is an important element in computing which discourse relations hold between discourse constituents of a dialogue. The SARG of a declarative anchor is simply belief transfer, i.e. that the addressee come to believe the truth of the anchor.

The simple constructed dialogue in (1) provides an illustration. Imagine that A and B are trying to complete some task at which neither is proficient, but at which Julie is known to be. We adopt the orthographic convention of indicating a final fall with a period, and a final rise with a question mark—hence the particular orthography of ((1-b)).

(1) a. A: [Julie]$_{CF}$ wouldn't do it that way.
     b. B: Well, Julie isn't here, / is she.

B's utterance (1-b) does not express any doubt regarding the truth of the anchor, but rather is used to get A to acknowledge that Julie is not present (and therefore that how Julie would accomplish the task is irrelevant to the present situation). As described above, this use of a tag question stands in a close correspondence to the SDRT relation *Acknowledgment*, which defines a type of relational speech act. *Acknowledgment* holds when an utterance entails that the SARG of the utterance to which it is attached has been achieved. In SDRT, for any discourse relation R, R_q relates α and β just in case any answer γ to β entails that $R(\alpha, \gamma)$. Thus, when a question is used to elicit an acknowledgement as in the case of the tag in ((1-b)), we use the relation *Acknowledgment$_q$* to specify its contribution

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follow Gunlogson in drawing the line between falling and non-falling tunes.

as a speech act.

Tag questions with final rising intonation are still biased toward an answer that confirms the content of the anchor, yet express some uncertainty or doubt on the part of the speaker. The dialogue in (2) illustrates this phenomenon.

(2)   a.   A: Can Julie do it for us?
        b.   B: Julie isn't here, / is she?

B's turn in (2-b) conveys a belief that Julie is not present (and thus answers A's question). The tag itself, however, expresses doubt or uncertainty, i.e. the speaker is open to the possibility that he is wrong. On this use the tag acts as a request for confirmation of the anchor. If the addressee has evidence to the contrary, he should provide it; if not, then he should acknowledge the truth of the anchor. We capture this reading via the SDRT relation $Confirmation_q$.

Both of these interpretations are biased, in that the anchor is asserted (see the forthcoming discussion in §3). This fact blocks the default intention associated with the interrogative component of the utterance, viz. to know an answer. But tag questions *can* function as neutral requests for information, as shown in (3).

(3)   a.   A: We need to find somebody who has done this before.
        b.   B: Julie isn't here = is she?

Several aspects of linguistic form appear to be necessary for a neutral reading to arise. First, they only appear to be possible when the anchor contains a negation and when there is little or no rhythmic break between the anchor and the tag (Ladd 1981, McCawley 1988, Huddleston and Pullum 2002). Moreover, the anchor of a neutral tag question is more likely to contain a H- phrase accent.

Ladd (1981) refers to the tag questions in (1-b) and (2-b) as *nuclear* tag questions, indicated by placing a slash between the anchor and the tag, and to the neutral reading in (3) as a *postnuclear* tag question, indicated with an equals

sign. Ladd's description of postnuclear tag questions corresponds in the ToBI scheme to an utterance consisting of a single intonational phrase, which itself consists of a single intermediate phrase (and a boundary tone). The nuclear pitch accent, i.e. the last pitch accent in the intermediate phrase occurs somewhere in the anchor. On this view, there is no pitch accent on any element of the tag itself. Nuclear tag questions then *might* consist of either two complete intonational phrases, or one, which itself contains two intermediate phrases. We find this description of postnuclear tags dubious. It is difficult in our experience not to hear a pitch accent on the auxillary verb in the tag. Of course, one could posit the existence of postnuclear pitch accents (which is what Ladd appears to have in mind), but this is a controversial claim. We do, however, agree with Ladd and other authors, notably McCawley (1988) and Huddleston and Pullum (2002), that neutral readings of tag questions contain a weaker boundary between the anchor and tag than nuclear tag questions. For these reasons, we prefer to recast the nuclear/postnuclear distinction in terms of intonational phrasing as follows: nuclear tag questions consist of two complete intonational phrases, one for the anchor and one for the tag. Postnuclear tag questions consist of one intonational phrase that is constructed from two intermediate phrases for the anchor and tag. We sketch an analysis below in which these prosodic differences conspire with syntax and semantics to yield two speech acts or one. In either case, the computation of the discourse function of the tag relative to the anchor procedes in much the same fashion. However, postnuclear prosody allows a neutral interpretation that nuclear prosody does not.

2.2   Negative Polar Questions

Standard semantic treatments of interrogative sentences predict that positive and negative polar questions such (4-a) and (5-a) are equivalent. On these approaches questions partition the space of logical possibilities, each element of

the partition being a proposition expressing a direct answer to the question (cf. Groenendijk and Stokhof 1997). At first glance, the prediction appears to be correct; the same propositions count as direct answers to both types of interrogative, as shown by the simple *yes* and *no* answers to (4-a) and (5-a) below.

(4)   a.   A: Is Jane coming?

           b.   B: Yes, she is. (= Jane is coming.)

           c.   B: No, she isn't. (= Jane is not coming.)

(5)   a.   A: Isn't Jane coming?

           b.   B: Yes, (of course) she is. (= Jane is coming.)

           c.   B: No, she isn't. (= Jane is not coming.)

However, negative polar questions differ from positive polar questions in two important respects. First, all negative questions convey a backgrounded attitude on the part of the speaker toward the proposition expressed by a positive answer (Ladd 1981, Büring and Gunlogson 2000, Han 2002, van Rooy and Šafářová 2003, Romero and Han 2004, Reese 2006a). (6-b), for example, is a felicitous continuation of (6-a), which conveys a stance of epistemic neutrality by the speaker toward the issue raised by the question. (6-c) is infelicitous in the same context, as it conveys a prior belief toward the issue raised by the question that conflicts with the neutrality required by the context, namely that the president read (or ought to have read) the briefing.

(6)   a.   I have no beliefs on the matter. I just want to know...

           b.   Did the President read the August 6 PDB?

           c. #Didn't the President read the August 6 PDB?

The second respect in which positive and negative polar questions diverge is that negative questions are ambiguous in a way that positive questions are not (Ladd 1981, Büring and Gunlogson 2000, Huddleston and Pullum 2002,

Romero and Han 2004). The two interpretations available to negative polar questions are disambiguated by including either a positive or negative polarity item. Negative questions that contain a PPI, as in (7), are biased toward positive answers. Ladd (1981) dubs this interpretation the *outside-negation* reading. Negative questions that contain an NPI, as in (8), on the other hand, are biased toward negative answers, Ladd's *inside-negation* reading.

(7)   a.   Didn't Kim read the report *too*?

        b.   Aren't there *some* vegetarian restaurants around here?

(8)   a.   Didn't Kim read the report *either*?

        b.   Aren't there *any* vegetarian restaurants around here?

We argue in §3 that outside- and inside-negation polar questions are not "biased" in the same sense. In the latter case, it might be more appropriate to claim that inside-negation polar questions are only felicitous in a *context* that is biased toward a negative answer (Büring and Gunlogson 2000), rather than to claim that the question itself is biased. Outside-negation polar questions like those in (7), we shown, involve an assertion, i.e., they are complex speech acts, whereas inside-negation negative questions as in (8) do not. We argue that outside-negation, like negation in the anchor of a neutral tag question, is metalinguistic.

2.3   Emphatic Focus Questions

Questions that contain a strong NPI, like those in (9), convey a bias toward a negative answer. Of the sentence types we consider in this paper, these have received the most attention from formal semanticists (cf. Abels 2003, Asher and Reese 2005, Borkin 1971, Guerzoni 2004, Krifka 1995, Ladusaw 1979, van Rooy 2003).

(9)   a.   Did Fred contribute *a red cent* to the campaign?

       b.   Did John *lift a finger* to help Mary?

       c.   Does Fred do *a damn thing* at the office?

       d.   Did Mary *bat an eye* when you threatened her?

Most of these analyses center around the semantic properties of polarity items, i.e. their lexical semantics, in combination with certain well-attested pragmatic principles. Krifka (1995) is the ur-paper in this respect. (van Rooy (2003) and Guerzoni (2004), for example, follow Krifka, at least in broad outline, in their analyses.)

But there is an underlying respect in which these accounts are *intonational*. Krifka (1995) is explicit about this, noting that since NPIs introduce alternatives over the denotation of the NPI, they resemble "items in focus". Krifka also notes that strong NPIs necessarily require "emphatic focus", which he associates with an emphatic assertion operator that mirrors the semantic effects of the focus sensitive lexical item *even*, whose meaning others, notably van Rooy (2003) and Guerzoni (2004) (following Heim 1984), assume is shared (at least in part) by NPIs. This raises the question of whether it is the semantics of strong NPIs which is responsible for bias, or whether certain the phonetic properties of the nucelar pitch accent are primarily responsible. The examples in (9), which we used to introduce the phenomena of negative bias, all contain strong NPIs. Consequently, the presence of such lexical items appears to be a sufficient condition for bias to exist.

But, we argue, it is not a necessary condition. Questions with domain wideners such as *any* and *ever* are neutral, unless read with the same emphatic stress as the minimizers in (9), as demonstrated by the minimal pair in (10-a) and (10-b) and the similar pair in (11). The existence of minimal pairs like those in (10-a)/(10-b) suggests that intonation plays some role in the derivation of bias.

(10)   a.   Did Fred contribute anything to the campaign?

       b.   Did Fred contribute ANYthing to the campaign?

(11)   a.   Has John ever voted for a democrat?

       b.   Has John EVER voted for a democrat?

More interestingly, "emphatic" intonation *alone* produces negative bias, as in (12-b) and (13) (from Sadock 1971). Both of these examples have narrow focus, intuitively a L* or L*+H nuclear pitch accent, on the matrix verb.[4]

(12)   a.   Do you need that porkchop?

       b.   Do you NEED that porkchop?

(13)   Did I TELL you that writing a dissertation was going to be easy?

(12) and (13) show that the presence of a strong NPI (or even an emphatically stressed domain widener) is not necessary for a question to be negatively biased. Rather, the foregoing discussion, we believe, establishes that intonation is the prime mover in deriving the bias in (9) – (13). And while it is tempting to adopt Krifka's analysis in terms of emphatic assertion, we note that it is insufficient, as it does not establish the existence of an assertion, which we argue is necessary given the evidence presented in §3.

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[4]   The location of the nuclear pitch accent need not fall on the matrix verb, nor be "narrow" in the usual sense. Take the example in (i) in which the nuclear pitch accent falls on *writing*, or (ii) in which the nuclear pitch accent occurs in an unmarked position.

(i)   Did I tell you that WRITING a dissertation was going to be easy?

(ii)   Did I tell you that writing a dissertation was going to be EASY?

Both (i) and (ii) expect a negative answer. (i) might be plausibly followed up by an utterance by the same speaker such as *No, I told you that* defending *it would be easy*. Likewise (ii) could be followed by *No, I told you that it's not as hard as most people think*.

3 Evidence for Multiple Speech Acts

Sadock (1971, 1974) provides several diagnostic tests for illocutionary force that appeal to the selectional constraints of specific discourse markers. The sentence initial parentheticals *after all* and *yet* take assertions as arguments, for example, but not neutral questions. *After all* collocates with assertions, for instance, but not neutral questions, as shown in (1-a) and (1-b) respectively.

(1)   It's fine if you don't finish the article today.

      a.   After all, your adviser is out of the country.

      b.   #After all, is your adviser out of the country?

Likewise, utterances prefixed with *yet* can *follow* assertions, cf. (2-b), but not neutral questions, as in (3-b).

(2)   a.   John is always late for work.

      b.   Yet, he continues to be promoted.

(3)   a.   Is John always late for work?

      b.   #Yet, he continues to be promoted.

There are parallel tests for questions. Sadock (1971, 1974) notes that sentence-initial *tell me* and the expression *by any chance* occur with questions, but not assertions, as established in (4) and (5).

(4)   a.   #John, by any chance, owns a car.

      b.   Does John, by any chance, own a car?

(5)   a.   #Tell me, John owns a car.

      b.   Tell me, does John own a car?

Furthermore, *tell me* and *by any chance* also distinguish between distinct sub-types of question. *Tell me* – as a simple request for a response from the addressee – selects for any type of question. *By any chance*, on the other hand, as an expression of epistemic uncertainty, only selects neutral questions. As such, it does not appear with biased questions, which we believe convey a commitment by the speaker.

In the following subsection, we apply these tests to the constructions discussed in the previous section, establishing that they instantiate complex speech acts with constituent types *question* and *assertion*.

3.1 Tag questions

3.1.1 Nuclear tag questions

Unsurprisingly, nuclear tag questions involve both an assertion and a question according to Sadock's diagnostics. (6) and (7) show that nuclear tag questions assert the anchor, according to the *after all* test. (6-b) and (7-b) can be pronounced either with a final rise or final fall, something we note as '*./?*'

(6)   a.   A: The conference should be exceptional this year.

     b.   A: After all, Julie is coming / isn't she ./?

(7)   a.   A: The conference might be sub-par this year.

     b.   A: After all, Julie isn't coming / is she ./?

The examples in (8-a) and (8-b), on the other hand, show that nuclear tag questions are not *neutral* questions, as they do not pass the *by any chance* test, but that they are questions, since they *do* pass the *tell me* test.

(8)   a.   Tell me, Jane {is/isn't} coming / {isn't/is} she ./?

     b.   #Jane {is/isn't} coming, by any chance / {isn't/is} she ./?

3.1.2 Postnuclear tag questions

Postnuclear tag questions exhibit more variation in use than nuclear tag questions.

Postnuclear tag questions with a positive anchor share the discourse functions of nuclear tag questions: they are assertions, as shown by (9) and (10), and (*tell me*) questions, (11). They are not neutral questions, however, as demonstrated by (12).

(9)   a.   A: Why is Nicholas so sure the conference will be dull?

        b.   A: After all, Julie is coming=isn't she ./?

(10)   a.   A: Pascal's not coming, so why is Nicholas so sure the conference will be a success?

        b.   A: After all, Julie isn't coming {#too/either}=is she ./?

(11)   Tell me, Jane {is/isn't} coming={isn't/is} she ./?

The inclusion of a positive polarity item in a postnuclear tag question with a negative anchor coerces a neutral question reading for examples like (13). The anchor is no longer asserted under these circumstances, as established by the neutral question test in (10-b).[5]

(12)   #Jane is coming, by any chance=isn't she?

(13)   Jane isn't coming {too/#either}, by any chance=is she?

The disambiguating role of the PPI is an important clue to understanding how this neutral reading arises. We believe that the negation in these examples scopes over the speech act itself, i.e., that it is a sort of metalinguistic operator. Metalinguistic negation, as has been noted by Horn (1989), neither licenses NPIs, nor anti-licenses PPIs.

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[5]   Neutral readings of postnuclear tag questions normally contain final rising intonation.

3.2   Negative polar questions

According to Sadock's diagnostics, outside-negation negative questions are as-sertions, while inside-negation NIs are not. Note that (14-b) can be preceded by *after all* when it contains the PPI *too*, but not when it contains the NPI *either*. Either version of (14-b) is felicitous in the discourse context established in (14) if *after all* is left off.

(14)   a.   A: Sue can't attend, so there'll be no syntacticians there.
        b.   B: What do you mean? After all, isn't Jane coming {too/#either}?

Similarly, (15-b) can follow (15-a) when it contains *too*, but not when it contains *either*.

(15)   a.   A: Isn't Jane coming {too/*either}?
        b.   A: Yet, Mary claims there will be no syntacticians there.

Again, if *yet* is left off of (15-b), then either the outside- or inside-negation read-ing of (15-a) is available. Because outside-negation negative questions pass the *after all* and *yet* tests, we maintain that they characteristically make assertions. This is not true of inside-negation questions.

Outside- and inside- negation negative questions, however, are still ques-tions: they can be answered with *yes* or *no* and they co-occur with the discourse marker *tell me*.

(16)   Tell me, isn't Jane coming {too/either}?

Outside-negation negative questions, consequently, are *both* questions and as-sertions, as demonstrated by the discourse in (17). The *tell me* prefixed to the utterance in (17-a) requires it to be a question.

(17)   a.   A: Tell me, isn't Jane coming too?

          b.   A: Yet, Mary claims there will be no syntacticians there.

At the same time, the *yet* prefixed to (17-b) requires (17-a) to be an assertion. As a result, in order for the the typing constraints of *tell me* and *yet* to be satisfied in (17), the negative interrogative in (17-a) must be simultaneously typed as an *assertion* and *question*. In other words, the type associated with (17-a) is complex in just the same way as indirect speech acts like (2-a) are; they combine two speech acts in one.

3.3   Emphatic focus questions

Finally, applying the tests to the type of interrogative sentences exemplified in (6) shows that they too are complex speech acts, as shown in (18) – (22) from Asher and Reese (2005).

(18)   a.   After all, does John lift a finger to help around the house?

          b.   Does John lift a finger to help around the house? Yet you continue to reward him.

          c.   Does John, by any chance, lift a finger to help around the house?

          d.   Tell me, does John lift a finger to help around the house?

(19)   I don't understand why you think that John is a liberal.

          a.   After all, has he EVER voted for a democrat?

          b.   #After all, has he ever voted for a democrat?

(20)   a.   Has John EVER voted for a democrat? Yet you still claim that he is a liberal.

          b.   #Has John ever voted for a democrat? Yet you still claim that he is a liberal.

(21)   a.   Has John, by any chance, EVER voted for a democrat?

  b. Tell me, has John EVER voted for a democrat?

(22) [Nicholas is reaching for the last porkchop, after already having had three.]

  a. You should have some fruit instead. After all, do you NEED that porkchop?

  b. Tell me Nicholas, do you NEED that porkchop?

Again, it is not the case that the illocutionary force of these questions is ambiguous or underdetermined. Rather, it is *overdetermined*. Biased questions are *simultaneously* assertions and questions as shown by (23).

(23) *After all*, has John *by any chance* EVER voted for a democrat?

Assuming that the arguments to *after all* and *by any chance* must be restricted to assertions and questions respectively, then both types must be available in the discourse context, otherwise a type clash should arise in (23), resulting in a kind of zeugmatic effect.

4 Toward an Analysis of Bias

The present section provides an outline of an analysis of bias within Segmented Discourse Representation Theory (SDRT: Asher and Lascarides 2003).[6] SDRT is a dynamic semantic theory of the interpretation of discourse and dialogue that takes the rhetorical connections between utterances seriously. A segmented discourse representation structure, or SDRS, is a triple $\langle A, \mathcal{F}, LAST \rangle$, where:

- A is a set of labels.

- $LAST$ is a label in A (intuitively, this is the label of the content of the last clause that was added to the logical form); and

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[6] More details can be found in Reese (in preparation).

- $\mathcal{F}$ is a function which assigns each member of A a formula of the SDRS language, which includes formulas of some version of dynamic semantics (DRT, DPL, Update Semantics, Martin Löf Type Theory, among others.)

This notion of discourse structure is very abstract and so very general.

To give a feel for the structures posited by SDRT and for its semantic implications about conveyed content, let's look to the temporal consequences of a text. the temporal structure of a discourse is more elaborate than what is suggested by the formal semantic analysis of tenses. There are clearly temporal shifts that show that the treatment of tenses cannot simply rely on the superficial order of the sentences in the text.

(1)   a.   (π_1) John had a great evening last night.
       b.   (π_2) He had a great meal.
       c.   (π_3) He ate salmon.
       d.   (π_4) He devoured lots of cheese.
       e.   (π_5) He then won a dancing competition.

(1-c) – (1-d) provide 'more detail' about the event in (1-b), which itself elaborates on (1-a). (1-e) continues the elaboration of John's evening that (1-b) started, forming a *narrative* with it (temporal progression). Clearly, the ordering of events does not follow the order of presentation, but rather obeys constraints imposed by discourse structure. Thus the eventualities that are understood as elaborating on others are temporally subordinate to them, and those events that represent narrative continuity are understood as following each other.

SDRT (Asher 1993, Asher and Lascarides 2003) provides the following discourse structure for (1) and permits a proper treatment of the temporal progression of the text. Here π_6 and π_7 are discourse constituents created by the process of inferring the discourse structure. See Asher and Lascarides (2003) for details. The discourse structure $\langle A, \mathcal{F}, LAST \rangle$ for (1) is as follows:

- $A = \{\pi_0, \pi_1, \pi_2, \pi_3, \pi_4, \pi_5, \pi_6, \pi_7\}$

- $\mathcal{F}(\pi_1) = K_{\pi_1}, \mathcal{F}(\pi_2) = K_{\pi_2}, \mathcal{F}(\pi_3) = K_{\pi_3}, \mathcal{F}(\pi_4) = K_{\pi_4}, \mathcal{F}(\pi_5) = K_{\pi_5},$
  $\mathcal{F}(\pi_0) = \textit{Elaboration}(\pi_1, \pi_6)$
  $\mathcal{F}(\pi_6) = \textit{Narration}(\pi_2, \pi_5) \wedge \textit{Elaboration}(\pi_2, \pi_7)$
  $\mathcal{F}(\pi_7) = \textit{Narration}(\pi_3, \pi_4)$

- $\text{last} = \pi_5$

SDRT contains a logical system for computing discourse structure on the basis of information available from syntax and compositional and lexical semantics. Our work over the past several years has been to see how intonation and prosody can be added as information sources to this system. There are two parts to this logical system—the first is a glue logic that contains axioms for inferring discourse relations between discourse constituents. In view of the fact that each discourse constituent has a unique label, the axioms exploit information about labels that is given by a description of the SDRS $\top$ assembled in the discourse thus far and of the new discourse constituent β to be linked to some available discourse constituent α in the SDRS. These descriptions specify discourse structures by saying which constituents are related to which other constituents and by saying in which constituent that information is to be found. Thus, a binary discourse relation like $Acknowledgement$ that holds between two discourse constituents in an SDRS will be expressed in the description language as a three place predicate symbol $Acknowledgement(\alpha, \beta, \lambda)$, which means that the constituent labelled by β serves as an acknowledgement to β and that this information is contained within the formula associated with label λ.

The axioms and rules of the glue logic exploit standard propositional logic connectives and a weak conditional operator $>$, which serves to represent defeasible rules about discourse structure. The general form of a defeasible rule about discourse structure is provided below.

- $(?(\alpha, \beta, \lambda) \wedge \mathrm{Info}(\alpha, \beta, \top)) > R(\alpha, \beta, \lambda)$

In words this rule says that if β is to be attached somehow to α in λ and certain information about α, β and the whole discourse structure $\top$ is available, then normally β is to be attached with R to α in λ. Such normality conditionals support modus ponens defeasibly. Thus, when the left hand side formula holds, we can defeasibly infer $R(\alpha, \beta, \lambda)$. Asher and Lascarides (2003) give a complete specification of the glue logic, in particular the defeasible consequence relation $\mid\!\sim$. In addition, to compute relations in dialogue SDRT makes use of an extension of the glue logic to reason about discourse participants' cognitive states. This logic is called the logic of cognitive modelling. This extension contains not only predicates relevant to computing discourse structure, propositional connectives and the weak conditional operator $>$, but also modal operators for belief and intention. We will express the contributions of prosody to computing discourse relations in the various types of biased questions we've described above using both the glue logic and the logic of cognitive modelling.

4.1   Complex speech acts

In §3, we showed that tag questions, outside-negation polar questions, and emphatic focus questions involve not only a question, but an assertive component as well. What we argue in the present section is that biased questions are, in fact, assigned a complex speech act type by the grammar. Following Asher and Lascarides (2001), we model complex types using the notion of a dot type in the sense of (Asher and Pustejovsky 2004). An utterance is a conventionalized complex speech act (CSA) if,

(a) the grammar assigns it a complex speech act type of the form $s_1 \bullet s_2$, such that s_1 and s_2 are distinct (incompatible) types of semantic objects; and (b) Gricean-style principles of rationality and

cooperativity link the constituent type s_1 to the type s_2 (Asher and Lascarides 2003, p. 310).

§3 provided the linguistic evidence that biased questions are assigned a complex speech act type, with a question component and an assertion component. Moreover, these component types are associated with distinct, incompatible semantic objects. The selectional constraints of the discourse markers mentioned above provide evidence of this. In addition, most compositional semantic theories assign the content of assertions and questions distinct, incompatible types of model-theoretic objects (or context-change potentials in a dynamic setting). Assertions, for example, are associated with propositions, or sets of possible worlds, whereas questions are associated with sets of propositions (Hamblin 1973) or propositional concepts (Groenendijk and Stokhof 1984). According to clause (a) in the above quotation, then, biased questions are conventionally assigned a complex speech act type *assertion • question*.[7]

The grammar is able to exploit both of the constituent types of a complex type in computing the rhetorical contribution of an utterance in a given discourse context through a rule of *Dot Exploitation*. If an utterance β attaches to an utterance α (with some undetermined rhetorical relation) in the discourse context λ – written $?(\alpha, \beta, \lambda)$ – and β is assigned a complex type $t_1 • t_2$ by the grammar, then new speech act discourse referents γ_1 and γ_2 of type t_1 and t_2 respectively are introduced. These new discourse referents are related to the original speech act referent β by a relation $O\text{-}Elab$, or "dot elaboration".

Clause (b) of the definition of conventionalized complex speech acts requires that Gricean-style reasoning about rationality and cooperativity link the constituent types of the complex type. We provide an informal discussion of this

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[7] According to the quotation from Asher and Lascarides (2003) complex types are asymmetric based on the flow of information between the constituent types. As we argue below, the flow of information in biased questions, perhaps counter-intuitively, appears to be from the assertion to the question. Intuitively, this is because the assertion blocks the default goal associated with the question, i.e., to know an answer.

reasoning in the subsections below. The requirement is formalized in the coherence constraint on complex types given below (Asher and Lascarides 2001). $\mathcal{C}$ encodes the linguistic competence of the discourse participants. As such, it contains conventionalized information about the mapping of linguistic form to compositional and lexical semantics, in addition to the SDRT rules for inferring rhetorical connections between utterances. $\mathcal{R}$ contains axioms for reasoning about the cognitive states, i.e. the beliefs, intentions and goals, of the discourse participants, and information from world knowledge.

- *Coherence Constraint on Complex Speech Act Types*:
  Suppose that:

    - $?(\alpha, \beta, \lambda)$

    - $\beta : t_1 \bullet t_2$

    - $O\text{-}Elab(\beta, \gamma_1) \wedge O\text{-}Elab(\beta, \gamma_2)$

    - $\gamma_1 : t_1 \wedge \gamma_2 : t_2$

  Then:

  $$\mathcal{R}, \mathcal{C}, ?(\alpha, \gamma_1, \lambda), ?(\gamma_1, \gamma_2, \lambda'), Info(\gamma_1, \gamma_2) \mathrel{\vdash\mkern-7mu\sim} R(\gamma_1, \gamma_2, \lambda'),$$

  where λ' labels an SDRS that results from attaching γ_1 to α in the SDRS labeled by λ.

The coherence constraint ensures that the constituent types of a complex speech act are related by a discourse relation R, inferred on the basis of conventionalized linguistic knowledge and Gricean-style reasoning about rationality and cooperativity formalized in $\mathcal{R}$.

Before addressing how the constituent types of the biased question that form the topic of this paper are rhetorically linked, a few more words need to be

said about the content of $\mathcal{C}$, $\mathcal{R}$, and what it means for an utterance α to have the type *assertion* in SDRT. To reiterate what was said above, $\mathcal{C}$ represents the linguistic competence of the discourse participants; it therefore provides information about syntax, phonology, and lexical and compositional semantics, in addition to information about the semantic contribution of rhetorical relations and SDRT's axioms for inferring rhetorical connections between utterances. As such, $\mathcal{C}$ includes the information that the negation in neutral tag questions and outside-negation polar questions is metalinguistic (however the notion of "metalinguistic" is cashed out formally). It also contains information about the intonational tune of an utterance and its interpretation. The direction of the $f0$ trend at the end of intonational phrases, for example, is often assumed to convey information about the speaker's relation to a proposition and its relation to the common ground (Gussenhoven 1984). Along similar lines, the placement and choice of nuclear pitch accent provides similar information, for example by marking information as new or backgrounded (Steedman 2000), and by introducing a (partially ordered) set of alternative propositions. Intonation thus provides the interpreter with a rich source of information for reasoning about the cognitive state of the speaker, or at least information about the speaker's "take" on the contents and structure of the discourse context.

This leads naturally into a discussion of the content of $\mathcal{R}$, a set of axioms for reasoning about the cognitive states of discourse participants based on what has been said in the course of a discourse or dialogue and on who said it. There are, for example, axioms that model Gricean-style reasoning about the rationality and cooperativity of discourse participants, in addition to axioms that associate, by default, certain goals with utterances based on their linguistic form. We refer to these goals as speech act related goals, or SARGs. *QRG*, for example, states that the default SARG of a question is that the speaker believe an answer to it. *Known Answers* blocks this default inference when the speaker already believes an answer.

- *QRG*: $Sanswer(\alpha, p) > \text{SARG}(\alpha, \mathcal{B}_{S(\alpha)}p)$

- *Known Answers*: $(Sanswer(\alpha, p) \wedge \mathcal{B}_{S(\alpha)}p) > \neg\text{SARG}(\alpha, \mathcal{B}_{S(\alpha)}p)$

Finally, we provide a few remarks on what it means in SDRT for an utterance to be an assertion. Our characterization of assertions is not controversial, but is captured in a very specific way in a discourse-based frameworks like SDRT. Searle and Vanderveken (1985) provide the following description of assertions: "the speaker presents a proposition as representing an actual state of affairs in the world of utterance (p. 37)." In other words, the proposition conveyed by an assertion should be true. Based on these observations, we provide the definition of assertions in (2).

(2) $((R(\alpha, \beta, \lambda) \wedge \textit{right-veridical}(R)) \vee (R'(\beta, \gamma, \lambda') \wedge \textit{left-veridical}(R)))$
        $\leftrightarrow \beta \colon \textit{assertion}$

A right-veridical rhetorical relation is one that entails the content of its right argument:

$$R(\alpha, \beta) \rightarrow K_\beta$$

A similar definition holds for left-veridical rhetorical relations. Rhetorical relations like *Narration*, *Explanation*, and *Correction* are examples of right-veridical and left-veridical relations, and so on our definition are all kinds of assertions; relations such as *Q-Elab* or *Narration$_q$*, on the other hand are not right-veridical. These and similar relations require their right-argument to be a question.

In the follow sections we discuss how the complex speech act types assigned to tag questions, outside-negation polar questions and emphatic focus questions satisfy the coherence constraint on complex types.

4.2   Tag Questions

Tag questions may or may not instantiate a complex speech act type. In the case of nuclear tag questions, we believe, clausal syntax and semantics, intonational phrasing, and the alignment rules of SDRT suggest the presence of two illocutionary acts: an assertion (based on the declarative anchor) and a question (derived from the tag). In the case of postnuclear tag questions, it is plausible to assume a complex type $assertion \bullet question$. Recall that the discourse functions available to postnuclear tag questions are a super-set of those available to nuclear tag questions. Whereas, both types of tag question function as requests for acknowledgment or confirmation, postnuclear tag questions can also function as neutral questions. The neutral use of postnuclear tag questions, however, has peculiar lexical semantic properties, viz. the presence of a metalinguistic negation operator.

The reasoning that links the anchor and tag of a nuclear tag question mirrors exactly that which links the constituent types of a postnuclear tag question. We therefore focus on the latter below, since we are interested for the most part in the analysis of biased questions as complex speech act types. As an illustration, we focus on the interpretation of tag questions as requests for acknowledgement. This interpretation, recall, is associated with falling intonation over the tag, a phonological feature that we assume provides no essential semantic information (cf. Reese and Asher 2006 for more discussion).

The axiom schema in (3) provides (indirectly) the semantic content of the relation used to model acknowledgement questions. $Acknowledgement_q$ links α to β just in case the answer to β entails that the SARG of α has been accepted or achieved. This semantic information, we assume, is sufficient to infer that $Acknowledgement_q$ links an utterance to the prior discourse context. This axiom, as part of SDRT's glue logic, is included in the set of conventional linguistic information $\mathcal{C}$.

(3)   *Axiom on Acknowledgement Questions*:
$$(?(\alpha, \beta, \lambda) \wedge \text{SARG}(\alpha, \phi) \wedge Sanswer(\beta, p) \wedge (\mathcal{B}_{H(\alpha)}(p) > \mathcal{B}_{H(\alpha)}\phi)) >$$
$$Acknowledgement_q(\alpha, \beta, \lambda)$$

We sketch below how the coherence constraint on complex types is satisfied for postnuclear tag questions with falling intonation. Importantly, the rhetorical link between the constituent types follows from compositional semantics and cognitive modeling alone. Let β be a postnuclear tag question. Assume that $R(\alpha, \beta, \lambda)$ and that the grammar assigns β a complex type $assertion \bullet question$.[8] Because $?(\alpha, \beta, \gamma)$ assumes that β has a simple type, the rule *Dot Exploitation* is called, yielding:

$$O\text{-}Elab(\beta, \gamma_a) \wedge O\text{-}Elab(\beta, \gamma_t),$$

where $\gamma_a : assertion$ gives the semantic contribution of the anchor and $\gamma_t : question$ gives the contribution of the tag. The coherence constraint on complex types, then, requires a rhetorical link between γ_a and γ_t. As we argued above, the requisite link is one of two relations: $Acknowledgement_q$ or $Confirmation_q$.

Because γ_a is typed $assertion$, it must attach within λ with a right-veridical relation – see (2). Given this constraint, the SARG of γ_a is that the addressee believe its propositional content. This means that in the schema in (3), ϕ is instantiated with $\mathcal{B}_{H(\gamma_a)}(p_{\gamma_a})$. It also follows from certain axioms of cognitive modeling that $\mathcal{B}_{S(\gamma_a)}(p_{\gamma_a})$[9] and from the compositional semantics of questions and answers that $Sanswer(\gamma_t, p_{\gamma_a})$. Finally, it is a theorem of the logic of cognitive modeling that $\mathcal{B}_{H(\gamma_a)}(p_{\gamma_a}) > \mathcal{B}_{H(\gamma_a)}\mathcal{B}_{H(\gamma_a)}(p_{\gamma_a})$, as belief is a K45 modality. As a result, in the absence of conflicting information the addressee infers that $Acknowledgement_q(\gamma_a, \gamma_t, \lambda')$.

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[8]   The argumentation that follows holds for nuclear tag questions, as well, except that there is no need in the case of nuclear tag questions to employ *Dot Exploitation*.

[9]   For tag questions, $S(\gamma_a) = S(\gamma_t)$.

We do not go into the details of the derivation of confirmation questions here, except to note that we assume that final rises do make a semantic contribution through either a modal expression of uncertainty (Šafářová 2005), or by expressing "ownership" in some sense of the underlying proposition expressed by the utterance (Steedman 2000, Gunlogson 2003). Reese and Asher (2006) and Reese (in preparation) provide proofs that this information blocks the default inference to $Acknowledgement_q$. The reason is that the final rise commits the speaker to inconsistent intentions (or, equivalently, SARGs), which we assume is ruled out by principles of rational action (see for example Cohen and Levesque 1990).

Neutral readings of postnuclear tag questions, as already stated, have a peculiar lexical feature, viz. a metalinguistic negation operator in the anchor. As such, the computation of their discourse function is a separate matter from that of the postnuclear tag questions described above. We adopt the analysis of metalinguistic negation common to multi-valued logics (see for example Bochvar 1981 as discussed by Beaver and Krahmer 2001) in which $\sim K_\pi$ is equivalent to $\neg(\pi : assertion)$, at least with respect to declarative sentences. Given our characterization of assertion, this means that it is not the case that π attaches to the discourse context with a right-veridical relation. If π does not attach with a right-veridical relation, then must attach with a rhetorical relation pertinent to a neutral question. Note that in the cases discussed above, the association of the anchor with an assertion blocks the default SARG of a question: if the speaker (of a tag question) believes the content of the anchor – which follows from cognitive modeling and the fact that it is asserted – then *Known Answer* will fire with respect to the tag's SARG. However, if the anchor contains a metalinguistic negation operator, the interpreter can no longer infer that the speaker believes the content of the anchor and there is nothing blocking *QRG*.

A remaining issue involves the relationship between "postnuclear" intonational phrasing and neutral interpretations: why can't nuclear tag questions have

a neutral interpretation? The answer, we maintain, lies in our assumption that nuclear phrasing forces two speech act discourse referents, one for the anchor and one for the tag. Postnuclear phrasing, on the other hand, assigns the tag question a dot type and *Dot Exploitation* will fire only if there is a type clash. This is normally the case, but metalinguistic negation – which forms part of the linguistic form of all neutral interpretations – cancels the assertion as described above.

4.3   Outside-Negation Polar Questions

Outside-negation polar questions, unlike their inside-negation counterparts, are also assigned a complex type *assertion* • *question* by the grammar. The connection between the constituent types varies according to the use to which the utterance is put. Outside-negation polar questions are felicitous in two types of situation, what Romero and Han (2004) call "contradiction" and "suggestion" scenarios. In the former situation, outside-negation polar questions are often prosodically marked in the same way as corrections, in which one finds some combination of higher mean pitch, greater pitch range, higher mean intensity and increased duration on the nuclear pitch accent (Swerts and Krahmer to appear). (4) provides an example of the contradiction use. *A*'s turn in (4-a) biases the context against the proposition that John is in Hawaii.

(4)   a.   A: John is coming to the party tonight.
        b.   B: Isn't John still in Hawaii?

Reese (2006b) provides a number of examples which show that the discourse function of outside-negation negative polar interrogatives often patterns with the use of positive assertions as denials. This is to be expected on our analysis, since we maintain that outside-negation polar questions involve a positive assertion. In these cases, it is natural to assume that the assertion obtained through

Dot Exploitation attaches the the preceding discourse context with a divergent rhetorical relation like *Correction* or *Counterevidence*. The presence of this the assertion requires, on pragmatic grounds, a reinterpretation of what question is being asked. A number of possibilities exist for attaching the question to the assertion. For example, the constituent speech acts may be related via $Acknowledgement_q$ or $Confirmation_q$, as with tag questions. Another possibility is that a stronger relation like $Counterevidence_q$ holds, in which case the question functions as a challenge to the addressee to back up a previous commitment by supplying counterevidence to the speakers assertion (see Reese 2006a).

Outside-negation polar questions also occur in neutral contexts, in which case they function as polite suggestions. (5), where (5-b) serves as an answer to the question in (5-a), illustrates this use.

(5)   a.   A: Who wrote *Gravity's Rainbow*?
        b.   B: Wasn't it Thomas Pynchon?

In this and similar cases, the component assertion, viz. that Thomas Pynchon wrote *Gravity's Rainbow*, attaches to the speech act discourse referent introduced by (5-a) with QAP (Question-Answer Pair), a right-veridical relation. The question component of the complex speech act type again attaches to the answer with $Acknowledgement_q$ or $Confirmation_q$ depending on the certainty conveyed by B.

4.4   Emphatic Focus Questions

Our treatment of emphatic focus questions is similar to the treatment of outside-negation polar questions given above. One difference, however, is that emphatic focus questions involve a negative assertion instead of a positive one. As with the use of outside-negation questions in contradiction scenarios, the assertoric

component of the complex type assigned to emaphtic focus questions attaches to the prior discourse context with a divergent rhetorical relation, i.e. *Correction* or *Counterevidence*. With respect to the dialogue in (6) from Asher and Reese (2005), note that B's utterance in (6-f) calls into question A's assertion in (6-a).

(6) a. A: John is a pretty decent husband.

 b. B: Does he do the dishes?

 c. A: No.

 d. B: Does he do the laundary?

 e. A: Well... no.

 f. B: Does he do a damn thing around the house?

The question intuitively challenges A to either provide counterevidence to B's negative assertion (indirectly providing evidence for her original claim in (6-a)) or to explain why they said it in the first place. These discourse functions are captured in SDRT with the relations $Counterevidence_q$ and $Explanation_q^*$ respectively.

Finally, we note in passing that the intonational properties of emphatic focus questions provide support for the characterization of their discourse function given above. Emphatic focus, to our ears, is marked with an L*+H nuclear pitch accent followed by a low-rising final tune, a L*+H L-H% contour in the ToBI framework. Liberman and Sag (1974) refer to this tune as the "contradiction contour" and Ward and Hirschberg (1985) that this contour – when occurring with marked spectral features – conveys speaker incredulity. In addition, Steedman (2000, 2003) maintains that L*+H marks contested thematic constituents. This intonational information, in addition to the lexical semantic properties of strong negative polarity items, most likely played the central role in the grammaticization of emphatic focus questions as complex speech acts.

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