Declarative Sentences and the L* H-H% Tune*

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1 Introduction

This paper comprises an attempt to push forward an exploration the possibilities made available by recent work in decompositional approaches to speech acts, specifically on the possibilities made available by commitment-based discourse models (Gunlogson 2001, Farkas & Bruce 2010, Malamud & Stephenson 2015, Farkas & Roelofsen 2017), which decompose speech acts like assertion and questioning into a component that has to do with speaker commitment, and a component that has to do with projecting future states of the conversation. Though work in these models has focused predominantly on defining particular speech acts within them, these models define a space of possible speech acts beyond those specifically defined, in terms of the various ways those components could interact with each other. In this paper, I propose a way to incorporate into these models work on intonational meaning (e.g. Bolinger 1989, Pierrehumbert & Hirschberg 1990, Bartels 1999, Westera 2017) in a way that comprises the beginnings of an exploration of that space.

The pairing of commitment-based discourse models and intonational meaning is a particularly natural one: decompositional approaches to speech acts give us a principledly chosen set of components with which to model the discourse effects of different kinds of sentences; the meanings of the intonational tunes that accompany utterances can be cast in terms of those components, allowing for compositional accounts of the discourse effects of form-intonation pairings in terms of the contribution of the form, and the contribution of the intonation. This pairing allows for more explanatory accounts of the behavior of form-intonation pairings than either tradition captures separately: moreso than work on speech acts that ignores intonational meaning and simply defines context update effects for form-intonation pairs, because we can

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explain such speech acts compositionally in terms of the effect of form and the effect of intonation, and moreso than work on intonational meaning that ignores modeling of context update, by linking intonational effects to independently motivated primitives and connecting intonational meaning to the typology of speech acts.

The goal of this paper is to provide a proof of concept of the usefulness of this pairing of intonational meaning and commitment-based discourse models by way of a case study of rising declaratives.

I will assume the commitment-based discourse model of Farkas & Bruce (2010), and implement within it an account of the L* H-H% and H* L-L% tunes as modulating whether or not the speaker is making a commitment (following Truckenbrodt 2006). I show that the resulting system derives the discourse effects that Farkas & Bruce (2010) define for asserting and questioning, while also deriving the observed behavior of rising declaratives entirely from the contribution of their declarative form and the contribution of their rising intonation, relying on no additional components in the discourse model beyond those independently motived to capture assertions and questions.

Though the scope of this paper is restricted to the investigation of steep, monotonic rises and steep, monotonic falls, on the intonational side, and to declaratives and interrogatives, on the sentence form side, I briefly discuss extensions to a broader range of intonational tunes and sentence forms in the conclusion.

The structure of this paper is as follows: in §2, I define the scope of the empirical investigation mentioned in the paragraph above, focusing on which uses of rising intonation are and are not being investigated here. In §3, I walk through the empirical behavior of rising declaratives in detail, arguing for four empirical generalizations that synthesize empirical arguments made in prior work, including generalizations that seem *prima facie* to be mutually contradictory. In §4, I present a brief survey of previous accounts of rising declaratives, highlighting problems that they encounter, and signposting ways in which my account makes use of their insights. In §5, I put forward my positive proposal, and show how it derives the relevant empirical facts. In §6 I show how my account of rising and falling intonation as modulating speaker commitment can handle data used by Farkas & Roelofsen (2017) to argue for intonational tunes as semantic operators affecting the denotations of the sentences they accompany, and in §7 I conclude.

2 Rising Intonation: Preliminaries

Rising declaratives (RDs) are declarative sentences accompanied with rising intonation. It is commonly observed that the discourse function of such sentences is to request information, while expressing some kind of bias that is not present in the corresponding sentences with interrogative syntax.

(1) a. You slapped him?
    b. There's a deer outside?

c. You got the job?

Phonologically speaking, these sentences are characterized by a low pitch accent rising to a high boundary tone. In the ToBI system of intonational transcription (Pierrehumbert 1980, Beckman & Pierrehumbert 1986), which treats intonational tunes as discrete sequences of binary high or low tones, this can be represented as an L* H-H% tune, where * marks a pitch accent, - marks a phrasal tone, and % marks a boundary tone:

(2) *You slapped him?*
L* H- H%

Though there is some consensus on the properties of RDs—for instance that they solicit addressee response, as questions do, but that they are felicitous in only a proper subset of the contexts in which standard polar interrogatives are appropriate—recent literature has proposed a broad variety of seemingly mutually contradictory empirical characterizations of the constraints on the distribution of RDs (i.e. the kind of bias they communicate) and a highly diverse set of theoretical techniques for capturing their behavior. My goal in this paper is to synthesize the insights, both empirical and analytical, of prior work into an account of RDs that improves on prior accounts on both fronts—empirically, by explaining the full range of seemingly contradictory empirical observations from prior work, and analytically, by giving a more explanatory account of RDs that derives their behavior entirely from the contribution of declarative form and the contribution of the L* H-H% tune, avoiding the stipulation of any *ad hoc* construction-specific conventional effects.

To preview the analysis, I will assume, following a suggestion by Truckenbrodt (2006), that intonational tunes in English are compositional on the level of the speech act, affecting in a consistent way the discourse update that is enacted by the utterance they accompany. Specifically, I will analyze the L* H-H% tune as an indicator that no changes to the speaker's commitments are being made by virtue of the utterance, and the H* L-L% tune as an indicator that the speaker is making a commitment to the informative content of the denotation of the sentence they've uttered. I show that formalizing this notion within the framework of Farkas & Bruce (2010) allows us to capture formally the full range of empirical facts about the behavior of RDs.

However, before either the empirical generalizations or the analysis can be discussed, it is important to note that the empirical focus here does not include all declarative sentences accompanied by a final rise. By focusing exclusively on steep monotonic rises and falls (the L* H-H% tune and the H* L-L% tune), I mean to exclude from consideration 'list intonation,' in which non-final portions of a list are accompanied by very shallow rises, as well as more complex intonational tunes that end with a rise, such as the rise-fall-rise contour (Constant 2012). I also mean to exclude assertive uses of RDs, which have been argued to be intonationally distinct from inquisitive uses of RDs, a point I discuss in the following subsection.

2.1 Assertive vs. Inquisitive RDs

Jeong (2017) argues that there are two different constructions in English that involve declarative sentences accompanied by monotonically rising intonation. One phenomenon is the one presented above, in which a steep rise accompanying a declarative sentence leads to it being interpreted, pretheoretically speaking, as a biased question. The other phenomenon is one in which a shallower rise accompanies a declarative sentence, leading it to be interpreted as a tentative assertion:

(3) **A**: Do you like Chinese food?

B: *I like orange chicken?*
H* H- H%

In this case, **B**'s utterance doesn't solicit any information from **A**, and **B** is taken to have committed to the truth of the sentence she has uttered. The rising intonation here, rather, indicates that **B** is not completely sure whether her contribution is an adequate answer to **A**'s question. Malamud & Stephenson (2015) call these 'unsure-of-move' uses of RDs. Jeong (2017) argues on the basis of experiments involving phonetic manipulation of the height of the rise that cases like these are intonationally distinct from information-soliciting uses of RDs. The two varieties of rising declaratives are actually associated with phonologically distinct intonational tunes: the biased question with a steep, L* H-H% rise, and the tentative assertion with a shallower, H* H-H% rise, as indicated above. She refers to the former as 'inquisitive' RDs and the latter as 'assertive' RDs, terminology that I adopt here.

I follow Jeong (2017) in treating inquisitive and assertive rising declaratives as two separate constructions, associated with two separate intonational tunes, and I address only inquisitive RDs in this paper. Throughout the rest of this paper, if I use the term 'rising declarative' or 'RD' without qualification, I intend it to refer to inquisitive rising declaratives, and when I place a question mark at the end of an example sentence, I intend it to signify that the sentence is accompanied by an L* H-H% tune.

3 Empirical Generalizations

I take four empirical generalizations to be crucial desiderata for the empirical adequacy of any account of inquisitive RDs:

(4) Four Crucial Generalizations
For any RD p? whose falling declarative counterpart denotes the proposition p
   a. Non-Assertiveness
   A speaker who utters p? does not assert that p is true
   b. Answer Solicitation
   An utterance of p? invites the addressee to weigh in on whether p is true

c. VARIABLE SPEAKER EPISTEMIC BIAS
An utterance of p? can license an inference to the speaker's suspecting that p is true or that it is false, depending on context

d. ANTICIPATION OF ADDRESSEE COMMITMENT
An utterance of p? is only felicitous when the speaker has reason to believe the addressee believes p

The rest of this section presents empirical arguments for each of the above generalizations. Generalizations (4a) and (4b) are uncontroversial, and so the arguments presented for them will be brief. Generalizations (4c) and (4d) are the subject of active debate. Various versions of (4d) have been proposed in prior work (e.g. Gunlogson 2001, Krifka 2015 and Jeong 2017—see §4.3 for details). (4c) is a synthesis of arguments made in prior work that RDs indicate negative speaker epistemic bias (Farkas & Roelofsen 2017) and that they indicate positive speaker epistemic bias (e.g. Gunlogson 2008, Westera 2017).

3.1 NON-ASSERTIVENESS

An inquisitive RD p? whose falling declarative counterpart denotes the proposition p does not commit the speaker to the truth of p—that is to say, the speaker does not assert that p is true by uttering p?.

(5) *[Context: Alvin is looking at facebook on his phone, where he sees a cryptic post by his friend Carrie, which seems to suggest that she's been fired from her job. He turns to Bertha, who is close with Carrie, and says:]*
A: Carrie got fired?
a. **B:** #Thanks for the heads up.
b. **B:** #Oh, I had no idea.

Bertha cannot felicitously reply by thanking Alvin for giving her information (5a) or by indicating receipt of previously unknown information with *oh* (5b).[1]

In this respect RDs pattern with interrogatives (6); the opposite is seen with falling declaratives (7).[2]

(6) *[Context: same as (5)]*
A: Did Carrie get fired?
a. **B:** #Thanks for the heads up.
b. **B:** #Oh, I had no idea.

(7) *[Context: same as (5)]*
A: Carrie got fired.

[1] This argument for the non-assertiveness of RDs dates back to Gunlogson (2001).

[2] These generalizations, of course, apply only to inquisitive RDs; assertive RDs pattern with falling declaratives with respect to these diagnostics.

a. **B:** Thanks for the heads up.
b. **B:** Oh, I had no idea.

To summarize: unlike falling declaratives, RDs don't appear to communicate information—discourse moves acknowledging receipt of information or signaling that one's interlocutor has made a commitment are not felicitous responses to them.

3.2 Answer solicitation

Another way in which falling declaratives behave differently from interrogatives is that the latter solicit an answer from the addressee, and the former do not:

(8) *[Context: Alvin is looking at facebook on his phone, where he sees a cryptic post by his friend Carrie, which seems to suggest that she has a new girlfriend. He turns to Bertha, who is close with Carrie, and says:]*
A: Did Carrie get a new girlfriend?
a. **B:** Yeah, she told me about it this morning.
b. **B:** I don't think so, maybe she's just trying to stir up drama.
c. **B:** #I haven't been having much luck in my love life lately.

(9) *[Context: same as (8)]*
A: Carrie got a new girlfriend.
a. **B:** Yeah, she told me about it this morning.
b. **B:** I don't think so, maybe she's just trying to stir up drama.
c. **B:** I haven't been having much luck in my love life lately.

An interrogative can be felicitously followed by an answer, whether positive (8a) or negative (8b), but it's infelicitous to reply by commenting on a related issue, rather than answering the question posed by the interrogative sentence (8c). The same is not true for falling declaratives. Agreement (9a) and (9b) are felicitous, but it's also felicitous to reply by commenting on a related issue (9c)—in this case, we take Bertha to have silently accepted the truth of Alvin's statement. Again, RDs pattern like interrogatives:

(10) *[Context: same as (8)]*
A: Carrie got a new girlfriend?
a. **B:** Yeah, she told me about it this morning.
b. **B:** I don't think so, maybe she's just trying to stir up drama.
c. **B:** #I haven't been having much luck in my love life lately.

It's felicitous to respond to p? by giving information about whether or not p is true (10a, 10b), but just as with interrogatives, it comes off as a non-sequitur to respond by commenting on a related matter (10c). RDs pattern with interrogatives in soliciting an answer.

3.3 Speaker epistemic bias

Rising declaratives have been argued to indicate, by some means or another, that the speaker has epistemic bias in favor of the proposition denoted by the corresponding falling declarative (see especially Gunlogson 2008 and Westera 2017)—however, other authors, most notably Farkas & Roelofsen (2017), have argued that rather than indicating strong bias in favor of p, an utterance of p? indicates a preference for p over $\neg p$ that is at best low, and at worst nonexistent. I'll call cases in which an utterance of p? allows us to infer that the speaker suspects p to be true cases in which the speaker has POSITIVE EPISTEMIC BIAS, and cases in which an utterance of p? allows us to infer that the speaker suspects p to be false cases in which the speaker has NEGATIVE EPISTEMIC BIAS.

In this section, I review data that has led analysts to these two contradictory positions. I argue that, though any satisfactory account of RDs must explain both sets of cases, neither should be taken to be a primitive feature of RDs. In §3.4, I argue that the form of bias that RDs reliably, conventionally communicate is the speaker's expectation that the addressee believes p, rather than an expression of the speaker's own bias (cf. Gunlogson 2001, Krifka 2015, Jeong 2017).

3.3.1 Positive Bias

Many of the situations in which rising declaratives are felicitous are cases in which the speaker has strong epistemic bias in favor of the proposition denoted by the corresponding rising declarative. Consider the following examples, based on examples from Gunlogson (2001).

(11) *[Context: The speaker has just seen her coworker enter the office wearing a wet raincoat. She says to him:]*
It's raining?

(12) *[Context: The speaker's typically overgrown coworker has just entered the office with a buzzcut. She says to him:]*
You got a haircut?

In (11), the speaker's visual evidence gives her strong reason to believe that it's raining—note the similarity to contexts used to facilitate the epistemic modal *must* (e.g. by Karttunen 1972), which is uncontroversially associated with strong epistemic bias in favor of its prejacent. In (12), again the speaker's visual evidence gives her strong reason to believe that her addressee has gotten a haircut—so strong, in fact, that one gets the sense that she is completely sure that he has gotten a haircut, and is merely being polite by avoiding using a falling declarative and thereby asserting to him facts about his own grooming.

To these cases, we can add double checking and expert consultation cases like the following:

(13) *[Context: The speaker and her addressee made plans two days ago to get drinks tonight. They haven't spoken about it since. She says to him:]*
We're still on for tonight?

(14) *[Context: The ship's captain is consulting with the android who maintains the ship about the logistics of their colonization voyage. The captain says:]*
We have, what, eight more recharge cycles to go before we get to Origae-6?

In (13), the speaker has no reason to suspect that the plans have been cancelled—the intuitive purpose of her utterance is to double-check that they still hold, and indirectly, to remind her addressee of the plans, and perhaps initiate a logistical conversation. In (14), taken from the film *Alien: Covenant*, the captain is pretty sure about how many recharge cycles are left before they reach their destination, but knows that the android is better informed than he is, and so he requests confirmation of the exact number from him. Cases like these suggest that p? is at the very least compatible with strong speaker epistemic bias toward p.

3.3.2 Negative Bias

Given the data in the previous subsection, an account of RDs that treats them as indicating positive speaker epistemic bias might seem desirable. However, Farkas & Roelofsen (2017) put forward data that problematize that view. First, consider rising declaratives as applied to questions of taste:[3]

(15) *[Context: Alvin and Bertha are watching a sunset, and Bertha has just expressed awe at its beauty. Alvin says:]*
This is a beautiful sunset? (based on F&R's 14)

In this case, Alvin can only be interpreted as indicating that he does not agree that the sunset is beautiful, and is surprised at Bertha's judgment.

Such skeptical or contradicting interpretations of RDs are not confined to discussions of matters of taste. Take for example the following naturally occurring example, brought to my attention by Donka Farkas (p.c.):[4]

(16) *[Context: George Stephanopoulos is interviewing Donald Trump.]*
DT: I think I've made a lot of sacrifices. I work very, very hard. I've created thousands of jobs, tens of thousands of jobs, built great structures. I've had tremendous success. I think I've done a lot.
GS: Those are sacrifices?

[3] The relevance of examples involving personal taste to rising declaratives is discussed most extensively by Malamud & Stephenson (2015).

[4] The source of the example is a Guardian article, available online at https://www.theguardian.com/commentisfree/2016/aug/01/donald-trump-off-rails-missteps-will-base-notice

In this case, again it is difficult to interpret the RD in any way other than expressing incredulity, skepticism or disagreement.

Finally, Farkas & Roelofsen (2017) cite cases in which an authority figure uses a rising declarative to contradict a statement made by one of their charges, either gently (17) or exasperatedly (18):

(17) *[Context: A student is solving a math problem in front of the class.]*[5]
Student: The answer to this problem is 5 because the square root of 9 is 2 and 2 + 3 is 5.
Teacher: The square root of 9 is 2? (F&R's 55)

(18) *[Context: A mother asks her child to set the table, and he does a particularly bad job before announcing himself to be done. The mother says to the child:]*
This table is set? (based on F&R's 69)

These cases, taken in concert with the two above, pose a great deal of difficulty for the idea that RDs intrinsically encode positive speaker epistemic bias—it is apparent that they can be used to express skepticism or contradiction in a wide variety of different circumstances.[6]

3.4 Anticipation of Addressee Commitment

We've seen above that some rising declaratives facilitate an inference to the speaker being epistemically biased in favor of the proposition denoted by the corresponding falling declaratives, and others facilitate an inference to the speaker being epistemically biased against the proposition denoted by the corresponding falling declarative. What unifies the cases above is not any generalization about what epistemic bias of the speaker's is communicated by rising declaratives, but rather is a generalization that is addressee-oriented: by uttering p?, the speaker indicates their expectation that the addressee believes p.

In order to argue for this generalization, I will revisit the examples discussed in the previous two subsections and show that manipulating the context such that the speaker has no reason to suspect that the addressee believes p renders p? infelicitous, even though the speaker's epistemic bias toward p remains constant.

Take for example (11), whose context is repeated here as (19a):

(19) a. *[Context: The speaker has just seen her coworker enter the office wearing a wet raincoat. She says to him:]*
It's raining?

[5] Farkas & Roelofsen (2017) credit this example to Jeroen Groenendijk (p.c.).

[6] Westera (2017) argues that cases like (17) and (18) are not necessarily problematic for a view that takes rising declaratives to intrinsically involve positive bias, as they could potentially be analyzed either as involving pretense (e.g., the teacher could be pretending, for rhetorical purposes, to be biased in favor of the square root of 9 being 2) or as rhetorical questions. Neither proposal is formalized, and it's not clear how either could be extended to the cases in (15) and (16).

b. *[Context: The speaker has just seen her coworker enter the office wearing a wet raincoat. She goes into her boss's office, from which the coworker's entrance was not visible, and says to her boss:]*
#It's raining?

In the context that licenses the RD (19a), the speaker has good reason to suspect that her addressee believes that it is raining—because she suspects that the explanation for his wet raincoat is that he just came in from the rain. In context (19b), though the speaker has the exact same reason to suspect that it's raining (i.e., the exact same degree of epistemic bias), again on the basis of her coworker's wet raincoat, she has no reason to suspect that her addressee believes that it is raining, as he did not see the raincoat, and so the RD is infelicitous.

We see something similar with double-checking cases. Consider (14), whose context is repeated here as (20a):

(20) a. *[Context: The ship's captain is consulting with the android who maintains the ship about the logistics of their colonization voyage. The captain says:]*
We have, what, eight more recharge cycles to go before we get to Origae-6?
b. *[Context: The ship's captain is talking to one of his passengers, who is unaware of the details of the logistics of the voyage. The captain says:]*
#We have, what, eight more recharge cycles to go before we get to Origae-6?

In the felicitous context (20a), the captain is pretty sure that there are eight recharge cycles left, due to his familiarity with the logistics of the voyage. He also knows that the android knows the exact number of recharge cycles left, as its memory is infallible and knowing the number of recharge cycles is part of its duty. So he has reason to suspect that the android believes there are eight recharge cycles left—if he's correct that that is the number, the android will know that that is the number. However, in (20b) the captain's addressee cannot be assumed to know the number of recharge cycles left, and so the captain has no reason to suspect that they believe that number to be eight. Again, the speaker's utterance of p? is made felicitous or infelicitous by manipulating whether they have reason to suspect that their addressee believes p, with their epistemic bias toward p remaining constant.

These two examples, in which the speaker has positive epistemic bias, might seem reducible to a more general pragmatics of questions. If the goal of uttering p? is to get your addressee to tell you whether p is true, then of course it would be unproductive to say it to someone who you know knows less about p than you do—in the same way, using a polar interrogative to ask whether p is true is infelicitous in contexts where you know your addressee is uninformed about p. However, if we move on to examine cases in which the speaker has negative epistemic bias toward p, we'll see that the felicity of p? is still dependent on the speaker having reason to suspect that the addressee believes p, in a way that is not reducible to the addressee being more qualified to resolve whether p is true than the speaker is.[7]

Consider (15), whose context is repeated here as (21a):

[7] See Gunlogson (2008) for extensive discussion of the role of asymmetric expertise in RDs, though she does not discuss cases where the speaker has negative epistemic bias.

(21) a. *[Context: Alvin and Bertha are watching a sunset, and Bertha has just expressed awe at its beauty. Alvin says:]*
This is a beautiful sunset?

b. *[Context: Alvin and Bertha are watching a sunset. Bertha hasn't said anything about it, but Alvin knows that she is generally unimpressed by displays of natural beauty. Alvin says:]*
#This is a beautiful sunset?

In the felicitous context (21a), Alvin has good reason to suspect that Bertha believes the sunset to be beautiful, namely that she just said so. In the infelicitous context (21b), Alvin has no such reason to suspect that Bertha believes the sunset to be beautiful, given her lack of response and her habitual unimpressedness at the natural world. Note that, unlike the positive epistemic bias cases above, it does not make sense to talk about this contrast in the felicity of p? in terms of the relative informedness of the conversational participants with respect p. In both contexts above, Alvin and Bertha have access to the same information about the sunset (i.e. they can both see it) and neither has any claim to being a more definitive judge of whether it is beautiful. I take this to support my claim that the relevant generalization about RDs really is that they are only felicitous if the speaker has reason to believe that the addressee believes p—that is to say, that they anticipate positive addressee response.

Finally, consider (16), repeated repeated here as (22a):

(22) a. **DT:** I think I've made a lot of sacrifices. I work very, very hard. I've created thousands of jobs, tens of thousands of jobs, built great structures. I've had tremendous success. I think I've done a lot.
GS: Those are sacrifices?

b. **DT:** I work very, very hard. I've created thousands of jobs, tens of thousands of jobs, built great structures. I've had tremendous success. I think I've done a lot.
GS: #Those are sacrifices?

In the examples above, the context for the RD is provided by the content of DTs utterance. In the felicitous context (22a), GS has good reason to suspect that DT believes that his achievements are sacrifices, because he prefaced his list of them by saying that he has made a lot of sacrifices. In the infelicitous context (22b), DT does not preface his list with that statement, giving GS no reason to suspect that DT believes those achievements to be sacrifices, and rendering his RD a non sequitur. Just as with the previous example, there is no change in either party's informedness about whether those achievements count as sacrifices, and no change in GS's epistemic bias about whether those are sacrifices—what changes is whether DT gives GS reason to believe that he takes those achievements to be sacrifices.

3.5 Takeaways

Though there is general consensus in the literature that RDs share at least three of the four properties discussed above (lack of speaker commitment, answer solicitation, and some form of

bias, though what form that bias takes has been controversial), accounts vary widely in which of these properties they take to be primitive features of RDs, and which they endeavor to derive from the other properties. The majority of previous accounts take bias to be a primitive feature of RDs (Gunlogson 2001, 2008, Krifka 2015, Malamud & Stephenson 2015, Farkas & Roelofsen 2017), some additionally treating answer-solicitation as a primitive feature of RDs (e.g. Farkas & Roelofsen 2017, who treat RDs as denoting questions) and others additionally treating lack of speaker commitment as a primitive feature (Gunlogson 2001, 2008, Malamud & Stephenson 2015). In §5, I put forward an account that follows Truckenbrodt (2006) in taking the only primitive feature of RDs that distinguishes them from falling declaratives to be lack of speaker commitment. I take the L* H-H% tune to indicate that the speaker is making no commitments by virtue of their utterance, and I show that the discourse model of Farkas & Bruce (2010) predicts that the other two properties of RDs will follow from a speaker putting forward a declarative sentence meaning but making no commitment to its content.

Before I present my proposal, §4 discusses prior approaches to the meaning of intonational tunes and to the discourse effect of rising declaratives. I hope to highlight the broad variety of insights, both empirical and theoretical, that are on display in prior work—the proposal in §5 comprises an attempt to derive the full range of empirical observations that are made in prior work, and to synthesize many of the theoretical innovations that have been put forward in response to them, even when those observations and those innovations might seem at first blush to be mutually incompatible.

4 Previous Accounts

In this section, I briefly summarize prior accounts of the meaning of intonational tunes and of the discourse effect of rising declaratives, indicating empirical problems where they crop up, and signposting the ways in which my account makes use of and synthesizes the insights and innovations of prior accounts.

4.1 Decompositional accounts of intonational tunes

Several prior accounts decompose the meanings of intonational tunes into the contributions of each tone in the tune. I instead focus on the level of the tune itself, defining the contribution of the L* H-H% tune holistically, rather than composing the contribution of the L* pitch accent and the H% boundary tone. The account I give of the L* H-H% tune is broadly congruent with prior decompositional analyses—formalizing the contribution of the components of that tune to its meaning is far beyond the scope of this paper.

4.1.1 Pierrehumbert & Hirschberg (1990)

Pierrehumbert & Hirschberg (1990) argue that the L* pitch accent signals 'non-predication': for example, in interrogative sentences, which are associated with the L* H-H% tune, the

speaker isn't predicating something of the accented phrase, but rather asking a question about it. They analyze the H% boundary tone as signaling dependence on a future utterance. In the case of a question, that dependence has to do with response elicitation; in lists, that dependence has to do with signaling that the list is not yet complete.

4.1.2 Bartels (1999)

Bartels (1999) adopts a meaning for H% that is comparable to that proposed by Pierrehumbert & Hirschberg (1990), in which it signals 'continuation dependence'. Rather than associating L* with non-predication, she analyses the L- phrasal tone as contributing an ASSERT morpheme, which sentences uttered with the H- phrasal tone lack.

4.1.3 Westera (2017)

Westera (2017) (elaborating on ideas that first saw print in Westera 2013) analyzes the H% boundary tone as signaling that the speaker doesn't believe themselves to be obeying all of the Gricean maxims. In the case of RDs, he shows that in some contexts it can be strongly inferred that the maxim the speaker does not believe themselves to be obeying must be Quality, and argues that it is this inference that explains the behavior of inquisitive RDs (assertive RDs, on this view, are RDs uttered in contexts in which it is inferred that the relevant maxim is Relation). This inference generates the lack of assertiveness of RDs: if the speaker does not believe themselves to be obeying Quality, then they cannot be taken to be endorsing the truth of what they've said. His system also derives that the speaker has positive epistemic bias, as there is a cost to violating Quality which is proportional to the probability that the uttered sentence is false, making RDs less costly the more confident the speaker is that the uttered sentence is true.

Because his system derives positive epistemic bias for inquisitive RDs, it is difficult to see how it could explain the cases of negative epistemic bias discussed in §3.3.2.

4.2 Meta speech acts (Krifka 2015)

Krifka (2015) defines an update effect for RDs in a 'commitment space' semantics for context-updating in dialogue. In a commitment space semantics, the current context is supplemented with a set of future contexts that could possibly develop from it via licit updates to the current context. Krifka's update for RDs acts on that set of licit future contexts rather than on the current context itself, performing a 'meta speech act' by removing contexts from that set of licit future contexts. For Krifka, the utterance of p? removes from the commitment space all future contexts that do not support p, though it has no effect on the current context itself. In essence, though p? does not assert p, it structures the space of possible future contexts in a way that requires its answer to be p.

4.3 Commitment-based discourse models

Perhaps the most productive line of work on RDs has been within the framework of commitment-based discourse models, in a line of thinking that can be traced back to Gunlogson's seminal dissertation. It is within this framework that my proposal is situated.

4.3.1 Gunlogson (2001)

Gunlogson (2001) proposes that while falling declaratives commit the speaker to some proposition p, rising declaratives commit the addressee to that proposition. This captures the addressee-orientedness of the empirical generalization argued for in §3, which is heavily indebted to Gunlogson's own empirical investigation. However, it's not clear what it means to commit one's addressee to something—surely, one has control over what one commits to! This problem is addressed by Jeong's (2017) refinement of Gunlogson's proposal, making use of projected commitments as introduced by Malamud & Stephenson (2015).

4.3.2 Truckenbrodt (2006)

Truckenbrodt (2006) takes up Gunlogson's (2001) analysis and proposes a reframing of it. He proposes that rather than intonation signaling who is being committed to a proposition (with falling intonation indicating the speaker and rising intonation indicating the addressee), we could instead take falling intonation to signal that the speaker is making a commitment, and rising intonation to signal that the speaker is *not* making a commitment. In other words, Truckenbrodt proposes that we could take the non-assertiveness of RDs to be primary, rather than their bias. This proposal was not formalized by Truckenbrodt within a discourse model that would make concrete predictions—below I formalize this idea within the framework of Farkas & Bruce (2010) and work through its consequences in formal detail.

4.3.3 Gunlogson (2008)

In later work, Gunlogson (2008) proposed that RDs are ways for speakers to make 'contingent commitments'—i.e., by uttering p?, the speaker indicates their willingness to commit to p provided that their addressee commits first. This is developed in a framework in which sourcehood is important—speakers can commit to a proposition as its conversational source, or commit to it dependent upon an interlocutor having committed to it as source. An RD, on this view, indicates the speaker's desire to make a dependent commitment: the addressee must commit as source to license the speaker's dependent commitment.

This proposal elegantly accounts for cases of positive epistemic bias, but it's difficult to see how it could be extended to account for negative epistemic bias cases, in which the speaker does not seem to indicate willingness to commit to p.

4.3.4 Malamud & Stephenson (2015)

Malamud & Stephenson (2015) do not make a distinction between assertive and inquisitive RDs, and their account seems better designed to account for assertive ones than inquisitive ones. On their account, the utterance p? differs from an assertion of p in two ways. First, it raises a 'meta-linguistic issue' about the appropriateness of the discourse move, which must be addressed before p can be added to the Common Ground. They also extend the commitment-based discourse model of Farkas & Bruce (2010) to include sets of projected commitments for all discourse participants. When a speaker utters p?, p is added not to the speaker's discourse commitment, but to their *projected* discourse commitments. To put it informally: when a speaker utters p?, they weakly assert it—they express a lack of confidence that it is a relevant contribution, but they nonetheless put the conversation into a state such that p will be a candidate for becoming Common Ground once that meta-linguistic issue is resolved, and project their own commitment to it. This seems to be a good account of assertive RDs, but it's difficult to see how it could capture the relevant facts about inquisitive RDs, namely the possibility of negative speaker epistemic bias (which clashes with the speaker projecting their own commitment to p) and the anticipation of addressee commitment to p, which falls out of neither the meta-linguistic issue nor the projected speaker commitment.

4.3.5 Farkas & Roelofsen (2017)

Farkas & Roelofsen's (2017) proposal is couched in the framework of inquisitive semantics (Ciardelli et al. 2013), and the formal details of their proposal presuppose some basic background in the notions of that framework, which their paper supplies, but which I've suppressed here for reasons of space. What is important for our purposes is that they treat rising intonation as contributing a semantic operator that when applied to a declarative sentence returns the denotation that a corresponding polar interrogative sentence would have—that is to say, in their system the rising declarative *It's raining?* has the same denotation as the polar interrogative *Is it raining?*.[8] They capture the difference in behavior between polar interrogatives and rising declaratives, despite their denotational equivalence, by proposing additional discourse effects that accompany marked ways of asking questions, like rising declaratives and tag interrogatives.

Farkas & Roelofsen (2017) extend standard models of discourse context to include representations of evidence-based credence (building on work by Northrup 2014), and propose that the additional discourse effect of p? is that in addition to asking whether or not p is true, it indicates that the speaker has evidence on the basis of which their epistemic preference for p over $\neg p$ is 'at most low'. This additional discourse effect is not derived from the interaction of declarative form and rising intonation, though Farkas & Roelofsen suggest that it is connected to rising intonation being generally correlated with low credence.

It is clear how this account captures the negative epistemic bias data, in which the speaker

[8] Their proposal for rising intonation is fully general, and captures the behavior of interrogatives as well—I've focused on how it applies to declarative sentences here for reasons of rhetorical expediency.

is at best skeptical of p (low credence) and at worst confident that p is false (zero credence), but it's not clear how it can account for the positive epistemic bias data. In double-checking cases like (13) and expert consultation cases like (14), the speaker seems to be indicating the opposite—that their credence in p is high.

4.3.6 JEONG (2017)

Jeong (2017) combines aspects of Malamud & Stephenson (2015) and Farkas & Roelofsen (2017)—she follows Farkas & Roelofsen in taking inquisitive RDs to have the semantics of polar interrogatives (i.e. she takes p? to denote $\{p, \neg p\}$), and she follows Malamud & Stephenson in assuming a model of discourse including sets of projected commitments. Jeong takes p? to add p to the addressee's projected commitments, straightforwardly accounting for anticipation of addressee commitment to p, and getting around the conceptual objection to Gunlogson (2001) that the speaker shouldn't have the authority to commit their addressee to anything—on this account, the speaker merely *projects* addressee commitment, which the addressee can then either sanction or deny.

4.4 SUMMARY AND PREVIEW OF THE ACCOUNT

My proposal synthesizes the insights of these prior proposals, while providing a simple and formally explicit account of RDs that derives their behavior entirely from the contribution of declarative form and the contribution of the L* H-H% tune.

Empirically, my proposal captures many of the observations outlined above. My proposal for the L* H-H% tune results in sentences accompanied by it being continuation-dependent and unassertive, in congruence with the generalizations Pierrehumbert & Hirschberg (1990) make about tunes ending in H% and Bartels (1999) makes about tunes lacking the L- phrasal tone. The analysis of rising declaratives captures the role anticipation of addressee commitment plays in their felicity (Gunlogson 2001, Krifka 2015, Jeong 2017); in terms of epistemic bias, it explains why p? can be uttered when the speaker suspects that p is true but needs confirmation from the addressee (Gunlogson 2008, Westera 2017) and also captures why it can be uttered when the speaker suspects (or knows) that p is false (Farkas & Roelofsen 2017).

Theoretically, my proposal follows Truckenbrodt (2006) and Westera (2017) in taking rising intonation to be a marker that the speaker is unwilling to commit to the truth of their utterance, though my implementation follows Truckenbrodt more closely. My proposal follows Krifka (2015) in cashing out predicted addressee commitments via the effect an utterance has on projected conversational futures, though I stop short of adopting his framework, and instead show that the same effect can be derived from more standard commitment-based discourse models.

Like the main line of prior work on rising declaratives (Gunlogson 2001, 2008, Malamud & Stephenson 2015, Farkas & Roelofsen 2017, Jeong 2017), my proposal is couched in a commitment-based discourse model. I implement my analysis in the model proposed by Farkas & Bruce (2010),

and show how the independently-motivated primitives of that model can generate the observed behavior of RDs without any additional components.

5 The Proposal

In this section I present a compositional account of inquisitive rising declaratives that derives their behavior entirely from the contribution of declarative sentence form and the contribution of the L* H-H% tune. I take the relevant contribution of declarative form to be that sentences in declarative form place a singleton set of propositions on the Table. Following Truckenbrodt (2006), I take the L* H-H% tune to indicate that the speaker is making no commitments by virtue of their utterance.

My proposal is formalized within the discourse model proposed by Farkas & Bruce (2010) (as are other recent accounts of rising declaratives—Malamud & Stephenson 2015, Farkas & Roelofsen 2017, Jeong 2017). I adopt this model because it allows us to rigorously examine the consequences of altering a standard act of assertion by calling off the speaker's discourse commitment to the proposition they've asserted. I show that formalizing the effect of calling off commitment to an asserted proposition within this framework predicts exactly the facts observed in §3: such a move hard-codes the fact that inquisitive rising declaratives don't involve commitment, but I show that it also predicts that they necessitate addressee response, that they anticipate positive response, and that they can indicate either positive or negative speaker epistemic bias, depending on the context.

I proceed like so: first, I give the necessary background on the Farkas & Bruce (2010) system in §5.1. Then, I give my proposal for the contribution of sentence form to the discourse effect of an utterance, and for the contribution of the L* H-H% and H* L-L% tunes, in §5.2. Finally, in §5.3 I walk through how the model predicts the empirical facts from §3.

5.1 Background: Farkas & Bruce (2010)

The model of assertion most commonly assumed within formal semantics and pragmatics comes from Stalnaker (1978).[9] This model has two basic components: a Common Ground, comprising the set of all propositions publicly assumed by all conversational participants, and a Context Set, comprising the grand intersection of the Common Ground, representing the set of all worlds compatible with all propositions publicly assumed by all conversational participants. For Stalnaker, to assert a proposition p is to propose that it be added to the Common Ground.

Farkas & Bruce (2010) formally decompose this conception of the act of assertion, so as to capture the proposal nature of assertion more clearly within the formal system, and so as to give a clear way of talking about the conversational effect of assertions that do not become Common Ground. This decomposition allows for a unified account of the discourse effects of

[9] Though see also Hamblin (1971) and Lewis (1979)

utterances of declarative and interrogative sentences in terms of their effect on the Question Under Discussion (QUD—Roberts 1996, Ginzburg 1996). They add three components to the model, in addition to Stalnaker's Common Ground and Context Set: sets of Discourse Commitments for each interlocutor; a Question Under Discussion stack called the Table; and a Projected Set of future Common Grounds that are possible given what is currently on the Table. I present these five core components slightly more formally here:

(23) BASIC COMPONENTS OF THE Farkas & Bruce (2010) MODEL:

a. COMMON GROUND (cg)
The set of all propositions that all discourse participants are publicly committed to

b. CONTEXT SET (cs)
The set of all worlds that are compatible with all propositions in the Common Ground ($= \bigcap cg$)

c. DISCOURSE COMMITMENTS
For all discourse participants X, there is a set DC_X of propositions X has publicly committed to that are not yet in cg

d. THE TABLE
A push-down stack of Issues (i.e. Hamblin sets—see below), the uppermost element of which corresponds to the current QUD

e. PROJECTED SET (ps)
The set of all Common Grounds that could result by adding an element of the current QUD to the current cg—i.e. by answering the current QUD

The role of each of these components will become clearer after we work through the basic examples of asserting and questioning within it. Before we do so, we must first discuss Issues and how they are resolved. In this model, conversations are driven by two forces: the desire to shrink the Context Set, driving interlocutors to raise Issues, and the desire to empty the Table, driving interlocutors to resolve them.[10]

(24) ISSUES
An Issue is a set of sets of worlds (= a set of propositions). To add an Issue to the Table is called RAISING an Issue.

(25) RESOLVING an Issue
If an Issue I is the topmost element of the Table, it is removed from the Table if $\exists p \in I.cs \subseteq p$

[10] If an Issue proves unresolvable, it can be removed from the Table if the participants agree to disagree, which I give a formal definition of here:

(1) AGREEING TO DISAGREE
An issue I can be removed from the Table if for any discourse participants X and Y, $\exists p \in DC_X, \exists q \in DC_Y . p \cap q = \varnothing \wedge (\exists r \in I.(\bigcap DC_X \cap cs) \subseteq r \wedge \neg(\bigcap DC_Y \cap cs) \subseteq r)$

This is a dispreferred strategy for emptying the Table, as it does not lead to shrinking the Context Set.

In other words, if the Context Set entails an answer to the current QUD, it is removed from the Table.

Farkas & Bruce take agreement with assertions to be a default, leading a proposition p to become Common Ground if one participant asserts it and no other participants object. I will assume that default agreement is available whenever at least one discourse participant has made a commitment that could potentially provide an answer to the current QUD. This can be expressed formally like so:

(26) DEFAULT AGREEMENT
For some issue I and discourse participant X, if I is the top element of the Table and $\exists p \in DC_X, \exists q \in I.(cs \cap p) \subseteq q$ and no discourse participants have made discourse commitments that are incompatible with p, p will be added to cg unless somebody objects

Note, crucially, that some participant must make an Issue-resolving commitment in order for the Issue to be resolved via silent assent on the part of the other discourse participants.

Farkas & Bruce treat speech acts as functions from contexts to contexts, where a context is a six-tuple containing the five basic components above, plus a set of discourse participants.

(27) DISCOURSE CONTEXTS
A context K_n is a tuple $\langle A_n, D_n, T_n, cg_n, cs_n, ps_n \rangle$
Where A_n is a set of individuals,
D_n is a set of sets of discourse commitments, one for each $a \in A_n$
T_n is a Table,
and cg_n, cs_n, and ps_n are a Common Ground, a Context Set, and a Projected Set

Farkas & Bruce (2010) define the assertion of a sentence s denoting a proposition p as an act that raises the Issue $\{p\}$, and adds p to the speaker's discourse commitments. Formally speaking, for an author a to assert a sentence s that denotes a proposition p in context K_n does the following:

(28) ASSERT$(s, a, K_n) \rightarrow K_{n+1}$, such that (cf. Farkas & Bruce's ex. 9)
i. $DC_{a,n+1} = DC_{a,n} + p$
ii. $T_{n+1} = T_n + \{p\}$
iii. $ps_{n+1} = \{cg_{n+1} + p\}$
iv. in all other respects, $K_{n+1} = K_n$

This is depicted visually in (29):

(29) a. **A**: I got a haircut.
b. UPDATE WITH *I got a haircut.*

DC_A	Table	DC_B

$cg_0, ps_0 = \{cg_0\}$

$\rightarrow$

DC_A	Table	DC_B
p	$\{p\}$	

$cg_1 = cg_0, ps_1 = \{cg_1 + p\}$

Note that this assertion has two primary effects: first, it adds p to DC_A, representing the fact that A has publicly committed to p. Second, it has raised the Issue $\{p\}$, giving rise to a Projected Set that contains only one possible future Common Ground: one that includes p. It makes sense that we would want A's assertion of p to project only a future Common Ground which includes p, because given A's commitment to p, it is no longer possible for $\neg p$ (or any of its subsets) to become Common Ground. So an assertion's pairing of a commitment to p with a singleton ps is very natural. However, commitment to p and projection of a singleton ps are separable in principle within this model, and the account of RDs below will pull them apart.

Farkas & Bruce (2010) define the act of questioning as raising the Issue denoted by the question, and making no change to the speaker's discourse commitments. Formally speaking, for an author a to question using a sentence s that denotes a Hamblin set P in context K_n does the following:[11]

(30) QUESTION$(s, a, K_n) \rightarrow K_{n+1}$, such that
i. $T_{n+1} = T_n + P$
ii. $ps_{n+1} = \{cg_{n+1} + p : p \in P\}$
iii. in all other respects, $K_{n+1} = K_n$

This is depicted visually in in (31):

(31) a. **A**: Did you get a haircut?
b. UPDATE WITH *Did you get a haircut?*

DC_A	Table	DC_B

$cg_0, ps_0 = \{cg_0\}$

$\rightarrow$

DC_A	Table	DC_B
	$\{p, \neg p\}$	

$cg_1 = cg_0, ps_1 = \{cg_1 + p, cg_1 + \neg p\}$

Note that the assertion in (29) allowed for the Issue raised to be resolved via default agreement, as A makes a potentially Issue-resolving commitment by virtue of her utterance. In this case, however, addressee response is necessitated: the speaker has made no commitments which could resolve the Issue on the Table, and so the addressee must make an Issue-resolving commitment if it is to be resolved. This explains why questions solicit addressee response: the speaker's discourse move has done nothing that will allow the Issue on the Table is going to be resolved, meaning the addressee is going to have to weigh in if the QUD is to serve its purpose of shrinking the cs.

In §5.2 I make a proposal for decomposing the acts of asserting and questioning defined by Farkas & Bruce (2010) into the contribution of sentence form and the contribution of intonational contour, and show that this proposal derives the two updates given above, before moving on to account for rising declaratives in §5.3.

[11] In Farkas & Bruce's original formulation, they define a polar question operator that applies to a proposition-denoting sentence radical. The reason for their focus on polar interrogatives is because they are concerned with explaining why both declaratives and polar interrogatives license *yes* and *no* responses. I've generalized their questioning act to non-polar interrogatives here.

5.2 Intonational Tunes as Speech Act Modifiers

Farkas & Roelofsen (2017) decompose the acts of asserting and questioning given above into the contribution of sentence form and the contribution of the basic effect of utterance. They propose that the basic effect of utterance is that the denotation of a sentence is placed on the Table, and its information content is added to the speaker's discourse commitments; the role played by the form of the sentence is in determining whether that denotation is a singleton set of propositions (declarative) or a non-singleton set (interrogative).[12]

I adopt their proposed decomposition almost entirely here. The one difference is that I take the addition of material to the speaker's discourse commitments not to be a part of the basic effect of utterance, but rather to be modulated by intonational tunes, following Truckenbrodt (2006).

I assume contexts to be 6-tuples as presented in (27). I assume that utterances are functions from contexts to contexts, extending Farkas & Bruce's asserting and questioning functions to take one additional argument, an intonational tune.:

(32) Utterances as functions:
$\textsc{Utt}(\langle a, s, t, K_n \rangle) = K_{n+1}$
Where a is the author of the utterance, s is the uttered sentence, and t is an intonational tune

Following Farkas & Roelofsen, I take the basic effect of any utterance to be adding the denotation of the uttered sentence to the Table:

(33) The basic discourse effect of utterance:
For any utterance $\textsc{Utt}(\langle a, s, t, K_n \rangle) = K_{n+1}$,
$T_{n+1} = \begin{cases} T_n + [\![s]\!] \text{ iff } [\![s]\!] \text{ is a Hamblin set} \\ T_n + \text{ID}([\![s]\!]) \text{ otherwise} \end{cases}$
Where ID is an operator that lifts propositions to singleton sets of propositions (q.v. Partee 1986, Uegaki 2015)

I make the standard assumption here that declarative sentences denote propositions, and interrogative sentences denote Hamblin sets (sets of propositions). Because the Table is a stack of sets of propositions, declarative sentences must be type-lifted to be able to be added to the Table.[13]

I assume the following conventional discourse effects for H* L-L% falling tunes and L* H-H% rising tunes, following Truckenbrodt (2006):

[12] In their system, intonation also plays a role in determining whether a sentence denotes a singleton or non-singleton set of propositions. I set this aside for the moment, discussing it in §6.

[13] Alternatively, one could follow Farkas & Roelofsen (2017) in assuming the framework of Inquisitive Semantics (Ciardelli et al. 2013), in which all sentences denote sets of propositions, obviating the need for a disjunctive definition and a type-lifter. I make the more conservative assumption here, but the choice is orthogonal to the analysis of RDs I propose.

(34) CONTRIBUTION OF H* L-L%
For any utterance $\text{UTT}(\langle a, s, t, K_n \rangle) = K_{n+1}$,
if $t =$ H* L-L%, $DC_{a,n+1} = DC_{a,n} + \bigcup I_{n+1}$

Informally, any utterance accompanied by the H* L-L% tune has the effect of adding the content of the Issue that has been raised to the speaker's discourse commitments.

(35) CONTRIBUTION OF L* H-H%
For any utterance $\text{UTT}(\langle a, s, t, K_n \rangle) = K_{n+1}$,
if $t =$ L* H-H%, $DC_{a,n+1} = DC_{a,n}$

Informally, any utterance accompanied by the L* H-H% tune has no effect on the speaker's discourse commitments.

It's worth briefly noting as a sanity check that this decomposition of conventional discourse effects into the effect of sentence type and the effect of intonational tune derives Farkas & Bruce's definition of assertion as the discourse effect of a falling declarative, and derives their definition of a question as the discourse effect of a rising interrogative.[14] A declarative sentence denoting p uttered with falling intonation will place $\{p\}$ on the Table, and commit the speaker to $\bigcup\{p\}$, i.e. to p. A polar interrogative denoting $\{p, \neg p\}$ uttered with rising intonation will place $\{p, \neg p\}$ on the Table, and make no additions to the speaker's discourse commitments.

5.3 ACCOUNTING FOR RISING DECLARATIVES

Given the discourse effects defined above, a declarative sentence uttered with the L* H-H% contour will behave in a unique way: the speaker will make no discourse commitments, but they will raise a singleton Issue, projecting only one future Common Ground. This is illustrated in (36):

(36) a. **A**: You got a haircut?
b. UPDATE WITH *You got a haircut?*

DC_A	Table	DC_B

$cg_0, ps_0 = \{cg_0\}$

→

DC_A	Table	DC_B
	$\{p\}$	

$cg_1 = cg_0, ps_1 = \{cg_1 + p\}$

This update differs minimally from the updates with falling declaratives and with polar interrogatives described above. It differs from the utterance of a falling declarative only in not adding p to the speaker's discourse commitments, and it differs from the utterance of a polar interrogative only in not projecting a Common Ground including $\neg p$. It is these two differences that predict the characteristic behavior of inquisitive rising declaratives.

It is immediately obvious how this account of inquisitive rising declaratives explains that they don't involve commitment: that is taken to be the conventional effect of the L* H-H% tune. In

[14] These acts are also derived by the decomposition proposed by Farkas & Roelofsen (2017), with the caveat that their questioning act involves the speaker making a trivial commitment to the set of all worlds.

the rest of this section, I explain how this account of inquisitive rising declaratives predicts the rest of the empirical facts encountered in §3: that inquisitive RDs solicit addressee response, anticipate that that addressee response will be positive, and can give rise to inferences of positive or negative epistemic bias on the part of the speaker, depending on context.

5.3.1 Accounting for answer solicitation

The shared conversational goal that Farkas & Bruce (2010) assume drives Issue-raising is the desire to shrink the Common Ground—therefore, in order for raising an Issue to prove conversationally useful, that Issue must be resolved. In order for an Issue to be resolved, it is necessary that some discourse participant make a commitment. If, by virtue of her utterance, the speaker makes a commitment that could potentially resolve the Issue she has raised (as the speaker does when uttering a falling declarative), the other participants can simply go along with her, and the Issue gets resolved via default agreement. However, if the speaker makes no potentially Issue-resolving commitment by virtue of her utterance (as in the utterance of an interrogative), somebody else will have to weigh in in order for the Issue to be resolved. The rising declarative in (36) solicits addressee response for the same reason that interrogatives solicit addressee response: the speaker has raised an Issue without making a commitment that could resolve it, meaning that a further commitment is necessary if the Issue is to be resolved.

To put it very simply: in the Farkas & Bruce (2010) model, all speech acts that do not result in a situation that facilitates default agreement solicit addressee response.

5.3.2 Accounting for anticipation of addressee commitment

The speech act carried out by an utterance of an inquisitive RD differs in exactly one way from the speech act carried out by the utterance of a corresponding rising polar interrogative: the latter results in a ps containing both $cg + p$ and $cg + \neg p$; the former results in a ps containing only $cg + p$. Therefore, the choice to use an RD instead of a polar interrogative is only pragmatically justifiable if the speaker has a reason to believe that $\neg p$ will not become Common Ground.

In the case of an utterance of a falling declarative, it is very easy to see why it makes sense that ps does not contain $cg + \neg p$: the speaker has committed to p, making it impossible for $\neg p$ to become Common Ground. However, in the case of an RD, the speaker has made no commitments that could prevent $\neg p$ from becoming Common Ground, so the explanation for why they've chosen an utterance that does not project $cg + \neg p$ cannot be traced to their own commitments. However, the parallel with falling declaratives is enlightening: in order for it to be impossible for $\neg p$ to become Common Ground, some discourse participant must make a commitment to p (or something that entails it). When the speaker utters an RD, they simultaneously make no commitment to p themselves (and flagrantly so, as they chose not to use a falling declarative, which differs in its effect only in terms of making that commitment to p—see discussion below), and indicate that they do not believe $\neg p$ can become Common Ground. Since they've made no commitment themselves, and somebody has to make an incompatible commitment for it to be impossible for $\neg p$ to become Common Ground, the only interpretation

available for their choice to not project $cg + \neg p$ and also not commit to p is that they expect their addressee to commit to p.[15]

Putting together the two pieces we've discussed so far, when a speaker utters an inquisitive RD, they solicit addressee response about whether p is true, and indicate that they think the addressee will say that it is. In other words, an inquisitive RD is a tool for soliciting addressee commitment to p. The rest of the explanation of the pragmatic effects of inquisitive RDs will be focused on the inferences that can be derived in different contexts about what the speaker's motivations for soliciting addressee commitment to p might be—I will argue that such reasoning accounts for inferences about the speaker's epistemic bias.

5.3.3 Accounting for epistemic bias

As mentioned above, the update carried out by the utterance of an inquisitive rising declarative differs only minimally from the update carried out by the utterance of a falling declarative: the latter adds p to the speaker's discourse commitments; the former does not. It is this difference that accounts for the range of inferences about speaker epistemic bias that are available for RDs in various contexts.

Because a speech act that would've committed the speaker to p is available, in order for the choice of an RD to be pragmatically justifiable the speaker must have some reason to avoid making that commitment. This licenses pragmatic inferences in context about what the speaker's reason may have been.

There are many reasons available in principle for why a speaker might want to avoid a commitment—they might suspect that p is true but be less than fully confident; they might also suspect that p is false, or even be confident that p is false. What the speaker's reason for avoiding commitment to p is often follows from reasoning about what motivated them to solicit addressee commitment to p.

There are multiple reasons why the speaker might solicit addressee commitment to p. It might be that the speaker suspects that p is true, and is willing to commit to p as long as the addressee does so first, perhaps because the addressee is better informed than the speaker about whether p is true. In a context that suggests that the speaker has this motive, we would generate an inference to their positive epistemic bias toward p[16]

Consider for example this case in which positive epistemic bias is inferred, originally discussed in §3.3.1:

[15] Note that this account cashes out the biasedness of RDs in much the same way as Krifka (2015): an RD makes no changes to speakers commitments, but does have an effect on the space of possible future contexts that are represented as reachable without controversy. However, in this case, that effect is derived from the interaction of the semantics of declarative sentences with general properties of the discourse model, whereas in Krifka (2015) it is an *ad hoc* effect of rising declaratives.

[16] This explanation of RDs in terms of soliciting addressee commitment to p which will be followed up by speaker commitment to p, and the role relative epistemic authority plays in such an explanation, is strongly indebted to Gunlogson (2008).

(37) *[Context: The ship's captain is consulting with the android who maintains the ship about the logistics of their colonization voyage. The captain says:]*
We have, what, eight more recharge cycles to go before we get to Origae-6?

In (37), the addressee is extremely knowledgable about how many recharge cycles remain before the ship reaches its destination, and so it is sensible to assume that the speaker will go along with the addressee's answer. The speaker uses a form that predicts that the addressee will commit to p, and the context makes it highly implausible that she will disagree with the addressee, and so we can infer that the speaker has positive epistemic bias toward p.

Now consider this case in which negative epistemic bias is inferred, originally discussed in §3.3.2:

(38) *[Context: A student is solving a math problem in front of the class.]*
Student: The answer to this problem is 5 because the square root of 9 is 2 and 2 + 3 is 5.
Teacher: The square root of 9 is 2?

In (38), the speaker is extremely knowledgable about basic arithmetic, and so it does not seem plausible that they have avoided making a commitment to the truth of the sentence they've uttered because they do not know for sure whether or not it is true, and are hoping that the addressee can confirm. Rather, the most plausible explanation for the speaker's having avoided committing to that sentence is that they don't believe it to be true.

In positive epistemic bias cases, we infer that the speaker's motivation for soliciting addressee commitment to p is so that they can double-check that p is true with their better-informed addressee before they make a commitment themselves. This is clearly not what is going on in (38). The account of the pragmatics of RDs that falls out of the analysis present here is flexible enough to capture cases like this as well. In contexts like this, the speaker is choosing to solicit addressee commitment to p because they want to provoke a disagreement over whether p is true. They infer that their addressee believes p, though they themselves do not, and so they solicit addressee commitment to p so that they can respond to it with disagreement.

To consider another negative epistemic bias case from 3.3.2, repeated here:

(39) *[Context: George Stephanopoulos is interviewing Donald Trump.]*
DT: I think I've made a lot of sacrifices. I work very, very hard. I've created thousands of jobs, tens of thousands of jobs, built great structures. I've had tremendous success. I think I've done a lot.
GS: Those are sacrifices?

In this case, **GS** has good reason to believe that **DT** thinks of the activities he listed as sacrifices—though **DT** did not overtly say "and those are sacrifices," his discourse would not be very coherent if he did not think they were. **GS** uses the RD to get **TD** to overtly confirm that he thinks those are sacrifices, so that **GS** can disagree. Indeed, the following continuation of (39) is perfectly natural:

(40) **DT:** They sure are.
GS: No they're not!

In general, we will expect cases in which the speaker elicits addressee commitment to p in order to provoke disagreement to be inextricably intertwined with negative epistemic bias, and cases in which the speaker elicits addressee commitment to p in order to verify that it is true to be inextricably intertwined with positive epistemic bias. In cases where it is not plausible that the speaker takes the addressee to have more epistemic authority over the relevant proposition, the most likely interpretation of the RD is incredulity or skepticism.

Because the account here does not hard-code any speaker epistemic bias into the conventional discourse effect of RDs, it is able to account for the full spectrum of previously discussed epistemic biases, unifying what are *prima facie* mutually contradictory generalizations. The core proposal—that the speaker avoids committing to p but predicts that the addressee will commit to it—can derive both positive and negative speaker epistemic bias toward p in different contexts.

6 Speech Act Modifiers vs Semantic Modifiers

I've given an account of RDs that derives their behavior from the contribution of declarative form in concert with the contribution of rising intonation. In doing so, I've made an assumption about how English intonational tunes contribute to the meaning of the sentences they accompany, namely that they do not affect the denotation of those sentences, but they do manipulate what kind of discourse update a speaker is performing with that denotation—they don't affect what a sentence means, only what a speaker is *doing* with that meaning. In other words, I've treated English intonational tunes as speech act modifiers.

This approach is suggested (as one of several theoretically plausible approaches to how to model the contribution of intonation compositionally) by Paul Portner like so: "...sentence mood and intonation specify two separate dimensions of discourse function, with the ultimate force of the utterance being a combination of the two." (Portner 2015, p.22)

Previous approaches to RDs have been heterogenous in what assumptions they make about the role intonation plays in making RDs behave like RDs. Gunlogson (2001) and Truckenbrodt (2006) have made comparable assumptions to me; Westera (2017) also seems to have made comparable assumptions, taking rising intonation to communicate that the speaker doesn't take themselves to be obeying all the Gricean maxims, though the framework in which his account is formalized is different enough from the one I assume that it's hard to make a direct comparison; others have been been agnostic about what intonation is contributing, defining the discourse update carried out by a rising declarative as a *sui generis* construction-specific effect, not in terms of the contribution of declarative form and the contribution of rising intonation (Krifka 2015, Malamud & Stephenson 2015, Jeong 2017). Farkas & Roelofsen (2017) stand as a notable exception within the landscape of recent work on the topic, proposing that intonational contours affect the semantic content of a sentence, (potentially) changing what they denote.

Of particular note is their account of rising intonation, which they analyze as contributing an operator that takes a denotation and adds to it the complement of its informative content, which when applied to the denotation of a declarative sentence returns the corresponding polar interrogative denotation. To explain the special properties of rising declaratives that distinguish them from polar interrogatives, Farkas & Roelofsen appeal to the idea that marked forms acquire extra discourse effects, and assign to RDs an additional discourse effect that they communicate information about the speaker's evidence-based epistemic preference for p over $\neg p$.

Farkas and Roelofsen offer two main empirical arguments in favor of the view that RDs have the same denotation as polar interrogatives. My goal in this section is to show that neither argument poses a crippling problem for the speech-act-modifier view of English intonation that I've assumed in this paper.

6.1 Slifting with RDs

The first empirical argument that Farkas & Roelofsen (2017) offer in favor of treating English intonational contours as contributing semantic operators that potentially alter the denotation of a sentence comes from the possibility for RDs to be slifted.

Slifting, or 's-lifting' (named by Ross 1973, but discussed earlier by Bolinger 1968) is a phenomenon in which a clause is followed (41a), or interrupted (41b), by what appears to be a subject and embedding verb:

(41) a. James is an anthropologist, I think.
b. James, I think, is an anthropologist.

Farkas & Roelofsen's (2017) observation is that slifting appears to be possible with RDs. The following example is modeled on Farkas & Roelofsen's example 44c, though they do not consider *asked*.

(42) 'Amalia left?', {she {wondered,asked},*it appeared.}

Because the verb *wonder* is generally assumed to need its complement to denote a question, i.e. a non-singleton set of propositions, Farkas & Roelofsen (2017) take this fact to show that RDs should be given such a semantics. They take the ungrammaticality of *it appeared* in this context to follow from the fact that *appear* does not embed questions.

Slifting is not a particularly well-understood phenomenon—see for instance Grimshaw (2011), who argues that slifted clauses display some properties of embedded clauses and some of matrix clauses—and the analysis of slifted interrogatives is actively under debate (see Haddican et al. 2014, Stepanov & Stateva 2016 for some recent perspectives). However, I will argue that, whatever the proper analysis of slifting turns out to be, there is reason to be skeptical that these cases involving slifted RDs involve genuine semantic complementation. I will argue instead that RDs are only acceptable in quotative uses of these embedding verbs.

First, observe that it is not possible to slift an RD with a first-person present-tense embedding verb as a commentary on the speech act one is currently carrying out (44), as is standardly possible with cases of slifted interrogatives that are uncontroversially to be interpreted as providing semantic complements to embedding verbs (43).

(43) What is that man doing over there on the roof, I wonder?

(44) #'Amalia left?', I wonder.

This pattern is congruent with other explicitly quotative uses of slifting:

(45) 'What is that man doing over there on the roof', I {shouted,#shout}.

The present tense here is possible in a narrative using the historical present, but as a true present tense, it is strongly infelicitous: the quote must have been uttered in the past in order for it to be possible to quote it.

Example (45) is illustrative for a different reason. Some verbs, like *shout* or *say*, can embed either finite clauses or quotes—when they embed finite clauses, they must be declarative, but there are no restrictions on the form of quotes that they embed:

(46) a. I shouted, 'Come over here!'
b. I shouted, 'Why are you doing this to me?'
c. I shouted, 'You're a monster!'

(47) a. *I shouted (that) come over here.
b. *I shouted why you're doing this to me.
c. I shouted that you're a monster.

Slifted RDs appear perfectly happily with such verbs:

(48) 'Amalia left?', I {shouted,said}.

The picture these facts paint is the following: slifted RDs do not provide Hamblin sets of propositions to the embedding verbs that take them as complements—if they did, they should be able to supply those sets to present-tense verbs, like slifted interrogatives can. Rather, slifted RDs are always quotative, explaining why they can cooccur with non-question-embedding quotative verbs.

Though a full theory of quotative verbs is far outside of the scope of this paper, let me sketch a toy version of such a theory here for the sake of concreteness. Quotative-embedding verbs are predicates of speech acts—they predicate that the quoted speech act had a particular property. We could explain the acceptability of RDs as quotative complements of *ask* by taking *ask* to predicate of a speech act that solicited addressee response by way of the speaker not making a potentially Issue-resolving commitment, and we could take *wonder* to be the subset of such acts that are self-addressed.

Donka Farkas (p.c.) points out that such a view would need to be percolated down to the semantics of the word *question*. Recall the following example, familiar by now from §3:

(49) *[Context: The ship's captain is consulting with the android who maintains the ship about the logistics of their colonization voyage. The captain says:]*
We have, what, eight more recharge cycles to go before we get to Origae-6?

In the film *Alien: Covenent*, this dialogue continues like so:

(50) **Android**: Is that a question sir?
Captain: Yes, that's a question.

We could again make sense of the possibility of using the word *question* to refer to RDs by taking the denotation of *question* to be the set of speech acts that do not involve speaker commitment, and solicit addressee response thereby.

6.2 Rising and falling disjunctive questions

The second argument for the view of intonational tunes as contributing semantic operators comes from Roelofsen & Farkas (2015), and has to do with an intuitive difference in the behavior of disjunctive questions with rising and falling intonation.

(51) a. Does she speak English, or French.
b. Does she speak English, or French?

If the disjunctive interrogative has a final fall, as in (51a), the question is interpreted as communicating that she must speak at least one of the two languages. No such inference accompanies disjunctive interrogatives with a final rise, as in (51b)—in this case, one does not get the sense that the speaker believes that she must speak at least one of the two languages.

Roelofsen & Farkas's (2015) explanation of this distinction follows from their semantics for intonational tunes, and their semantics for declarative and interrogative sentence form. In brief, they take the operator contributed by the intonational tune to apply to a sentence radical first, followed by the operator contributed by sentence form. Focusing on the relevant factors: Rising intonation takes any set of propositions φ and adds to it $\overline{\bigcup\varphi}$, converting for instance $\{p\}$ to $\{p, \neg p\}$, and also calls off the effect of sentence form. Falling intonation has no effect, passing the sentence radical on to the operator contributed by sentence form. Declarative sentence form converts any set of propositions to a singleton set of propositions via grand union, and interrogative sentence form has the same effect as rising intonation *only if* the denotation it applies to is a singleton set of propositions; otherwise it does nothing. The reader is invited to consult Roelofsen & Farkas (2015) §3.2 for the full formal details.

How does this account for the facts about the interaction of intonation and disjunctive interrogatives? The disjunction is taken to denote a set of two propositions, $\{p, q\}$. In the case of falling intonation (51a), the operator contributed by falling intonation passes that denotation along to

the operator contributed by interrogative form; that subsequent operator makes no changes to the denotation, as it is already a non-singleton set. The payoff is that what is put on the table by the utterance is $\{p, q\}$. For disjunctive interrogatives accompanied by rising intonation (51b), the operator contributed by rising intonation takes $\{p, q\}$ and adds to it an alternative that is the complement of the informative content, and, trivially, calls off the operator contributed by interrogative form. The payoff is that what is put on the Table is $\{p, q, \overline{\bigcup \{p, q\}}\}$.

In short, disjunctive interrogatives accompanied by falling intonation place two alternatives on the Table, p and q, and the speaker is committed to $\bigcup\{p, q\}$, as Farkas & Roelofsen (2017) take the speaker's commitment to the informative content of what they put on the Table to be an intrinsic effect of any utterance. Disjunctive interrogatives accompanied by rising intonation, however, place three alternatives on the Table: p, q, and neither p nor q. The speaker in this cases makes only a trivial commitment to the set of all possible worlds.

The facts in (51) can be explained in a different way, however, given the conventional discourse effects I've assigned to rising and falling intonation. I'll make similar assumptions to Roelofsen & Farkas (2015) regarding the basic denotation of disjunctive interrogatives, namely that minus intonation, the denotation of a disjunctive interrogative is $\{p, q\}$. Because in my system, intonation doesn't affect denotations, that will be the denotation placed on the Table by any utterance of a disjunctive interrogative, regardless of intonation. In my system, a disjunctive interrogative accompanied by falling intonation will behave exactly like it does in Farkas & Roelofsen (2017): $\{p, q\}$ is placed on the Table, and the speaker commits to $\bigcup\{p, q\}$. In asking the question, the speaker commits themselves to one or the other of the alternatives placed on the Table being true. Rising intonation, in my system, incurs no speaker commitments. Though the speaker is still placing $\{p, q\}$ on the Table, she makes no commitments thereby that would rule out neither of those alternatives being true, explaining the asymmetry.

7 Conclusion

Many previous analysts have called inquisitive RDs 'biased questions', e.g. Krifka (2015) and Farkas & Roelofsen (2017). Though my account does not treat them as questions in the semantic sense, the intuition behind that term is cashed out in a principled way: their intuitive questioniness comes from the contribution of the L* H-H% tune, which makes no discourse commitments for the speaker and solicits addressee response thereby; their intuitive biasedness comes from their declarative form, which projects only one future Common Ground, in effect anticipating that addressee response will be positive.

I've argued here in favor of brining together two strains of work in a particular way. On the one hand, decompositional accounts of speech acts, like Farkas & Bruce (2010), break discourse effects down into a few moving parts, so as to allow a formal explanation of how different speech acts differ, and what they have in common. In doing so, they allow for the description of a broader variety of speech acts than the few they were designed to model, as those moving parts can be combined in a broad variety of ways. On the other hand, accounts of intonational

meaning are often explained in terms of what kind of act the speaker is performing by way of an utterance accompanied by a particular intonational tune. What I hope to have demonstrated here is the viability of a particular approach to combining those two strains of work: the discourse effects of intonational tunes can be defined in terms of the primitives made available by decompositional accounts of speech acts, allowing for compositional accounts of the discourse effect of form-intonation pairs in terms of the effect of the sentence's form and the effect of its intonation. Such accounts can help us explore the possibilities made available by such models beyond the speech acts specifically defined by their creators.

In the case of inquisitive rising declaratives in particular, I hope to have shown that exploring the dynamics of the Farkas & Bruce (2010) model allows us to derive a very broad range of prior empirical observations from the basic idea that rising intonation communicates that the speaker is making no commitments (Truckenbrodt 2006), in conjunction with the idea that any utterance places the denotation of the uttered sentence on the Table (Farkas & Roelofsen 2017). It allows us to capture the full range of empirical phenomena addressed in prior empirical work on the subject, and to do so in a more satisfyingly explanatory fashion, by capturing the behavior of RDs entirely in terms of the interaction between rising intonation and declarative form, and by deriving that behavior entirely from mechanisms independently proposed to model the speech acts of asserting and questioning, with no appeal to additional *ad hoc* modifications to the basic model.

The view of the role intonational tunes play in the discourse effects of utterances that I've developed here is ripe for further explanation. I'll close by pointing out two especially productive avenues for future work that could push this view forward. The first line of work would push forward the basic idea that discourse effects can be defined compositional in terms of the contribution of sentence form and intonational tune by examining the behavior of the L* H-H% and H* L-L% tunes on sentence forms beyond declaratives and interrogatives. Investigation of the effects of intonational tunes on imperatives is an obvious first step, and has been addressed in recent work by Portner (2015), Keough et al. (2016), Jeong & Condoravdi (2017). The second line of work would push forward the space of intonational tunes under consideration. I've given accounts only of L* H-H% and H* L-L% here; less steep rising and falling tunes have been argued to have distinct effects on declaratives (Jeong 2017) and imperatives (Keough et al. 2016), and a broad variety of more complex tunes have been argued to have principled discourse effects as well, like the 'surprise-redundancy contour' (Sag & Liberman 1975) and the rise-fall-rise contour (Constant 2012).

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