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IMPLICATING UNCERTAINTY: THE PRAGMATICS OF FALL-RISE INTONATION

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An analysis of naturally occurring data reveals that the FALL-RISE intonational contour makes a context-independent contribution to utterance interpretation: the conveyance of speaker UNCERTAINTY. Two necessary conditions are proposed for the felicitous use of fall-rise: (a) some item referenced in an utterance must be perceived as linked by a scalar relationship with its context; and (b) speaker uncertainty with respect to the scale or scalar value evoked must be plausible. The conveyance of uncertainty constitutes a pragmatic contribution to utterance interpretation, which we analyse in Gricean terms as a case of conventional implicature. Other effects, such as irony or politeness, may be conveyed via this implicature.*

A major issue confronting studies of intonation is the question of whether intonational contours have context-independent meaning; and, if so, how that meaning is to be characterized. In these studies, the FALL-RISE contour in English (hereafter FR) has often served as a case in point.[1] We argue that FR does make an independent contribution to utterance interpretation: the conveyance of speaker UNCERTAINTY. Furthermore, we argue that this contribution is best analysed as a case of Gricean conventional implicature.

Our analysis of FR is based on a corpus of naturally occurring tokens collected by us and by others from service encounter exchanges, radio and television programs, and informal conversations between November 1983 and November 1984.[2] It is found that previous studies have failed to distinguish FR from other falling-rising contours, or to recognize its particular discourse function. We show how FR may be distinguished from other contours, and we provide a new account of its meaning.

In §1, we define the phonetic properties of FR. In §2, we review the literature on this contour; in particular, we discuss how previous studies have described it phonetically and have characterized its contribution to utterance interpretation. We then present an alternative analysis based upon two necessary conditions for felicitous FR: speaker perception of some salient scale, discussed

* We would like to thank Dave Graff for his assistance in the preparation of the spectrograms used in our analysis and Franz Seitz for his help in recording the contours. We also thank Dwight Bolinger, Debbie Dahl, Tony Kroch, Robert Ladd, Janet Pierrehumbert, Susan Pintzuk, and Ellen Prince for helpful comments on earlier drafts. Thanks also to Debbie Dahl, Anny Ewing, Kathy McCoy, Martha Pollack, and Ethel Schuster for providing some of our naturally occurring data. This paper represents a much revised account of research carried out at the University of Pennsylvania, and introduced in Hirschberg & Ward 1984.

[1] For the purposes of this study, we adopt the terminology of Ladd 1980.

[2] The corpus consists of over one hundred tokens of the contour, which were noted 'on the fly'. Except where indicated, all examples of FR in this paper are drawn from our corpus. In some cases, the speaker's and hearer's own interpretations of utterances were available; in others, we have relied upon our own intuitions and those of other native speakers. Obviously, one never has direct access to the intentions of other speakers.

in §3, and speaker uncertainty about some aspect of this scale, discussed in §4. Finally, in §5, we propose that the contribution of FR to utterance interpretation can best be seen in a Gricean framework.

1. DEFINITION. FR is a type of falling–rising intonational contour, distinguishable from others in that it is SCOOPED (cf. Ladd); i.e., pitch peak is reached late in the accented syllable (SYL). There may be more than one such SYL within the FR. For each SYL, a relatively abrupt drop in pitch must occur within the following two syllables. In addition, FR is characterized by a sentence-final rise in pitch. We provide a spectrogram of this contour with a single SYL in Figure 1.[3] (In this and subsequent examples, \x/ is used to identify *x* as a SYL with FR.)

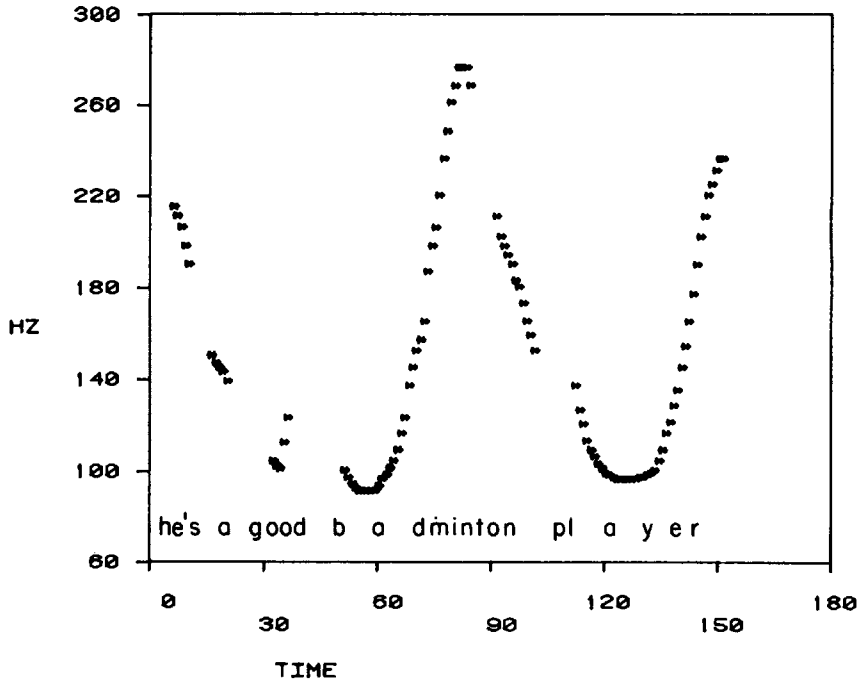

FIGURE 1.

Though the majority of our examples exhibit only one SYL, utterances with more than one do occur, as in Figure 2.[4] Bing 1979 claims that each contour may contain only a single prominent syllable, and that the phenomenon of Fig. 2 should be seen as multiple contours within a single utterance. However, we believe that this example is better described as a single contour with several SYL's, or prominence peaks, since the intrasentential contour-final rises that Bing's account would necessitate in such cases are not obligatory; e.g., Fig. 2 shows no rise after *player*.

SYL can occur within any lexical item, but it must always be the lexically-stressed syllable of that item.[5] Moreover, there are no constraints on the po-

[3] The spectrograms presented here were produced with the help of Dave Graff, using the Interactive Lab System. The tape recordings were digitized at a sampling rate of ten kHz and analysed for F_0 estimations using a combination of zero-crossing and cepstrum computations.

[4] FR with multiple SYL's will be discussed in more detail in §4.1.

[5] Exceptions may occur in certain metalinguistic contexts; for a discussion, see Horn 1985.

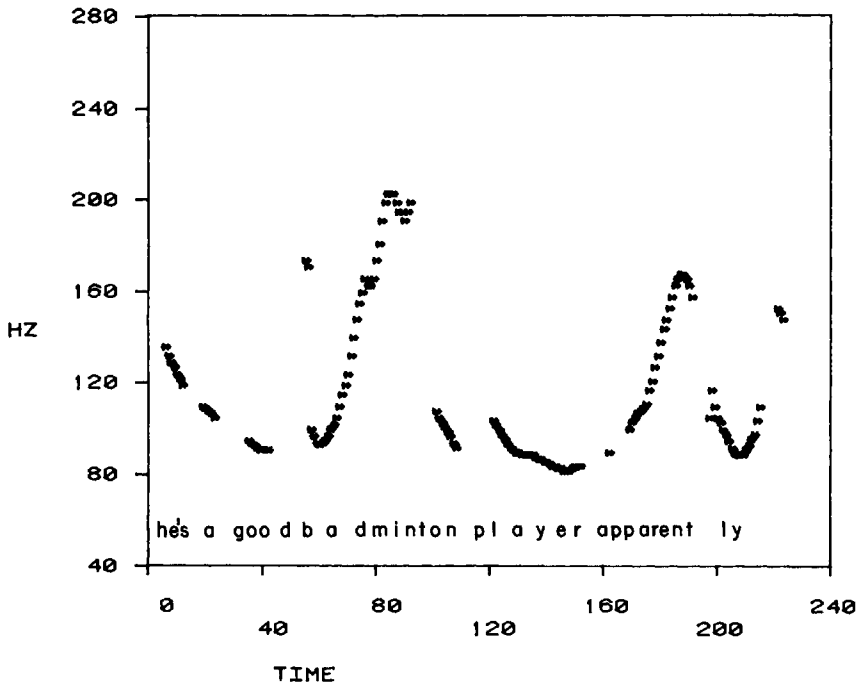

FIGURE 2. FR contour with two SYL's.

sition of the item(s) containing SYL (S) in a sentence, as shown in these constructed examples:[6]

(1) a. A: Did Victor get tickets for the Fellini triple feature?
B: Ve\ron/ica did.
b. A: Did Victor get tickets for the Fellini triple feature?
B: He's con\sid/ering it.
c. A: Did Victor get tickets for the Fellini triple feature?
B: He bought tickets for \some/ triple feature.
d. A: Did Victor get tickets for the Fellini triple feature?
B: He got tickets for the Paso\li/ni triple feature.
e. A: Did Victor get tickets for the Fellini triple feature?
B: He got tickets for the Fellini \dou/ble feature.

Having presented our phonetic description of FR, we now examine the contour in the light of previous studies.

2. PREVIOUS STUDIES. FR has been discussed in the literature under a variety of names in various intonational frameworks: by Pike 1945 as a '°2–4–3' contour; by Bolinger 1958 as a subtype of 'Accent A'; by Kingdon 1958 as 'Tones III and V'; by Schubiger 1958 and Gunter 1972 as a 'falling–rising' contour; by Halliday 1967 as 'Tone 4'; by Jackendoff 1972 as Bolinger's 'B Accent'; by O'Connor & Arnold 1961, Ladd 1980, and Cutler 1977 as 'fall rise'; by Liberman & Sag 1974 as 'contrastive stress within contradiction contour'; by Bing 1979 as an 'A-rise' contour; and by Moulton 1982 as '2°32 ↑'. This

[6] Where possible, we follow Ladd in selecting examples which contain SYL in polysyllabic lexical items, in order to illustrate FR contour more clearly and to distinguish it from simple contrastive stress.

proliferation of terminology reflects disagreement over two general aspects of the phenomenon: (a) what the phonetic properties of the contour are, and how it is to be classified with respect to other intonational contours; and (b) how its 'meaning' should be characterized—and, on a more theoretical level, whether the contribution it makes to utterance interpretation is syntactic, semantic, or pragmatic.

2.1. PHONETIC DESCRIPTION. It is not always possible to map between various intonational systems with certainty. Thus Pike (54–7) appears to include FR under his °2–4–3 contour, itself an amalgam of contours °2–4 and °4–3. However, since his primary contours need not extend over entire sentences, he does not require the sentence-final rise for °2–4–3 that we believe characterizes FR.

In Bolinger's three-way distinction of PITCH ACCENT (1958), FR is subsumed under Accent A, which is characterized by an abrupt fall either within the accented syllable (which is prolonged to accommodate this fall) or within two syllables after the accentable syllable. More recently, Bolinger (p.c.) identifies an 'AC contour' which he believes is the same as our FR. The distinguishing features of this AC contour are the abrupt fall and the terminal rise—which indeed are essential to FR. However, like other descriptions of falling–rising contours (e.g. Bing 1979, Ladd 1980), Bolinger's description of AC lacks several features which characterize FR.

To illustrate the relationship between our FR and the other contour descriptions enumerated above, it is necessary to map them into a single descriptive system. For this purpose, we adopt Pierrehumbert's (1980) description of intonational patterns, or TUNES. She describes these as structured strings of low (L) and high (H) tones in the F_0 contour. A well-formed tune for an intonational phrase consists of one or more pitch accents, aligned with stressed syllables on the basis of the metrical pattern of the text, plus single tones which characterize the phrase accent and the boundary tone. A pitch accent consists either of a single tone or an ordered pair of two tones, such as L+H. Accented syllables are marked by a star (*), as L*+H. Tones which lead or follow an accented syllable are marked by a raised hyphen ($^-$). Thus * and $^-$ correspond to a stressed/unstressed distinction. Boundary tones are marked with %.

In this framework, FR can be represented as $L^*+H^-L^-H\%$. Returning to the spectrogram of FR in Fig. 1, we can see that the nuclear accent is L^*+H^-; the primary stressed syllable has a very low F_0 (indicating an L tone), and the F_0 peak (the H tone) occurs in the following syllable. The following phrase accent is low (another L tone), and the boundary tone is H, indicating sentence-final rise.

Note that the FR contour in Fig. 1 differs crucially from that referred to by Bolinger as AC and by Bing as A-rise, which is shown in Figure 3.[7] Here we have, in Pierrehumbert's terms, an $L^-+H^*L^-H\%$ tune. The important distinction between this tune and that of Fig. 1 is the different alignment of the stressed syllable with F_0. While primary stress occurs on the L tone in our FR

[7] This sentence corresponds to Bing's ex. 90 of the A-rise contour.

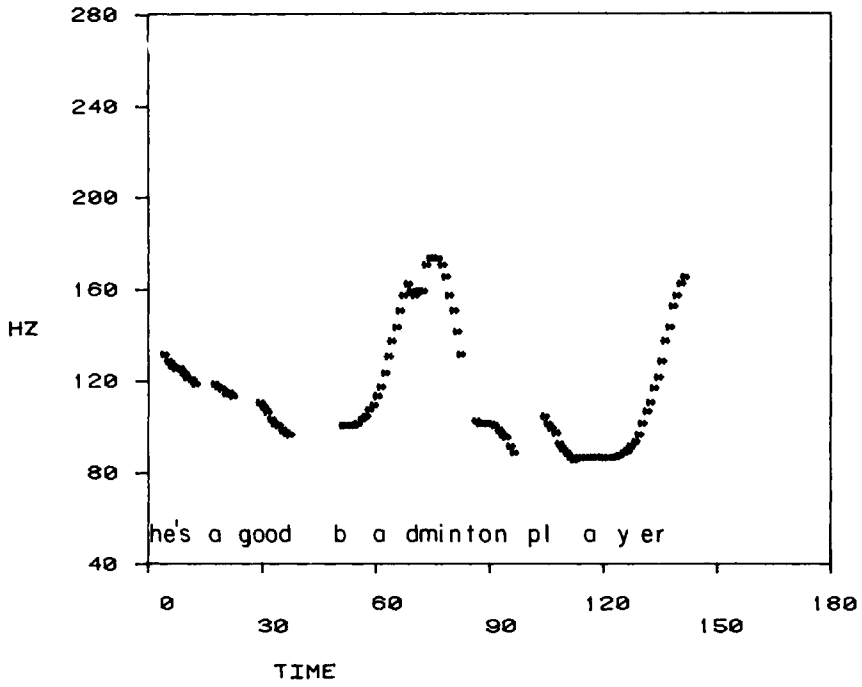

FIGURE 3. The A-rise contour.

contour in Fig. 1, it occurs on the H tone in Fig. 3.[8] There may also be significant differences in the pitch frequencies of these two contours, in the initial L tone, and in the duration of the stressed syllable; however, these possibilities await further study.

2.2. CONTRIBUTION TO UTTERANCE INTERPRETATION. The difficulty in distinguishing FR from more general falling–rising contours on phonetic grounds has led to attempts to assess its contribution to utterance interpretation in more general terms as well. For Halliday (27), this contribution is 'a statement or answer with reservation (''there's a 'but' about it'')'; for Bolinger (p.c.), 'incompletion' or 'up-in-the-airness'; for Ladd (153), 'focus within a set'; for Bing (205–6), reservation or implied contrast; for Gussenhoven 1983, 'selection of a variable from the background'; for Liberman & Sag (423–5), contrast. However, we believe that FR induces a much more specific understanding than these authors have recognized. Here we provide further evidence that FR is distinct from other falling–rising contours, and we show reasons to revise previous characterizations of its contribution to utterance interpretation.

To our knowledge, the earliest discussion of the meaning of FR is by Pike: his °2–4–3 represents both a phonetic and a semantic amalgamation of two other primary contours. Thus, he says (55), the 'meaning' of °2–4–3 is the speaker's combination of 'introspection with close attention to some single item. The combination of these attitudes may be expressed by the °2–4–3 con-

[8] Pierrehumbert (66) identifies the A-rise contour as H*L$^-$H%. However, it is not clear whether the phonological distinction between H*L$^-$H% and L$^-$ + H*L$^-$H% triggers any semantic/pragmatic difference (Pierrehumbert, p.c.) What is clear is that both differ from our FR.

tour, which adds to the INCOMPLETE DELIBERATION meaning of the °4–3 contour the CONTRASTIVE ATTENTION of the contour °2–4.' However, this approach to intonational meaning fails to capture the fact that FR induces a particular understanding, which cannot be seen as the mere sum of its parts.

Bolinger's subsumption of FR under his AC contour leads him to include its meaning under the general notion of 'up-in-the-airness'. However, just as AC and FR may be distinguished on phonetic grounds, so too can they be distinguished in terms of the contribution they make to utterance interpretation. For example, FR is possible only in 2:[9]

(2) A: What interesting people came to the party?
B: Ve\ron/ica.
(3) A: Who came to the party?
B: #Ve\ron/ica.

If FR conveys simple 'up-in-the-airness', this disparity cannot be explained. However, while FR is impossible in 3, AC (i.e. rise on *-ron-*, fall on *-i-*, and sentence-final rise) is fine here:

(4) A: Who came to the party?
B: VeRONica/.

Without the scooped SYL, AC may be interpreted as conveying Bolinger's incompletion: A will expect B to list other guests.

Jackendoff (258–65) claims that FR marks the 'independent variable' in a multiple-focus sentence. When a sentence has two foci,[10] one will receive an 'A pitch accent' (falling) and one will receive a 'B pitch accent' (FR).[11] For Jackendoff, the 'A accent' denotes a dependent variable (i.e. what is asserted); the 'B accent' denotes an independent variable (what is presupposed).

To account for FR within a sentence containing only a single focus, Jackendoff proposes an implicit 'affirmation–negation' variable, the sole function of which is to prevent items like *not, only*, and *even* from 'undergoing association with focus'—i.e. to exclude them from the presupposition (255). Jackendoff claims that, in a single-focus sentence with a 'B accent', the affirmation–negation variable necessarily excludes these items from the presupposition. Thus a 'B accent' on *Fred* in 5 excludes *not* from the presupposition:

(5) FRED doesn't write poetry in the garden. (= Jackendoff's 6.137)

Thus the presupposition is 'X writes poetry in the garden'—not 'X doesn't write poetry in the garden.' However, with an 'A accent' on *Fred*, no such exclusion occurs, and the presupposition of the sentence remains 'X doesn't write poetry in the garden.'

Serious problems with Jackendoff's analysis have been widely noted,[12] two

[9] We use # to denote inappropriateness or infelicity.

[10] For Jackendoff (353 ff.), the semantic representation of a sentence is divided into 'focus' and 'presupposition', where stress marks the focus constituents. The presupposition is formed when the focus in the semantic interpretation is replaced by a variable.

[11] As Ladd notes (216), Jackendoff mis-applies Bolinger's terminology by calling FR a 'B accent'; in Bolinger's system, both fall and FR are 'A accents'.

[12] See Liberman & Sag (419), Bing (199–201), and Ladd (146–7), among others.

of which are particularly germane to our discussion. First, as Gussenhoven (79) points out, Jackendoff's claim that FR necessarily removes *not* from the presupposition is simply false. Consider this:

(6) A: How can anyone with any sense not like San Francisco?
B: \Bill/ doesn't like it.

Here clearly the presupposition is 'X doesn't like San Francisco.' FR thus need not exclude negation from the presupposition.

Second, Jackendoff claims (264) that, when the first auxiliary of a single-focus sentence is stressed to focus affirmation–negation, this stress must be realized with falling intonation, not FR. However, as 7 shows, this is not the case:

(7) A: What time should I come in tomorrow?
B: 3:30. [...] Can you come in at 3?
A: I \can/. Should I?

Thus Jackendoff's account of FR fails on at least two counts.

Liberman & Sag (423–5) contend that FR is a special case of their C[ontradiction] C[ontour], namely CC with contrastive stress. This claim has been convincingly refuted by Ladd's classic example (150–52):

(8) A: Elephantiasis is incurable.
B: You're crazy. !Elephantiasis isn't incurable![13]

Assuming that Liberman & Sag are discussing FR here, we agree with Ladd that it is phonetically distinct from CC. Liberman & Sag's syntactic diagnostic for CC is the impossibility of embedding the contour.[14] But Ladd notes that it is indeed possible to embed FR:

(9) A: Elephantiasis is incurable.
B: You're crazy! #It's been demonstrated by medical science that !elephantiasis isn't incurable!

(10) A: Elephantiasis is incurable.
B: You're crazy! It's been demonstrated by medical science that elephan\ti/asis isn't incurable.

Also, not all instances of FR can be analysed as contradictory, as Bolinger notes (1982:507 ff.) FR can occur even when nothing appears to be contradicted:

(11) A: Will Uncle Michael and Aunt Carolyn be coming to the rehearsal dinner?
B: They're in\vi/ted.

(12) A: Do you know what time it is?
B: I can find \out/.

Ladd (153) proposes an account of FR along the lines of Jackendoff's focus/presupposition theory. He claims that FR 'adds the information that the variable of the focus/presupposition is a member of a set which is in the context'. For Ladd, the meaning of FR is 'something like "focus within a given set"'. It picks something out of a set of possibilities [either explicit or implicit in the

[13] We indicate CC by !...!

[14] But cf. Bolinger (1982:511–14) for an interesting criticism of Liberman & Sag's diagnostic.

discourse] and focuses on it, but it specifically notes the connection of the set of possibilities to the context.' In the following example, Ladd argues that FR conveys that *cat*, the focused element, is a member of the set of animals evoked by A's query:

(13) A: Did you feed the animals? (= Ladd's 16)
B: I fed the \cat/.

While the superset is explicitly mentioned in 13, Ladd notes that this need not be the case, so long as the speaker is able to infer such a superset from his knowledge of the hearer, the domain, or the discourse context.

To illustrate the semantic contribution of FR, Ladd contrasts it with falling intonation. He claims that, while falling intonation indicates new and unpredictable information, FR connects an item to a set in the context. Where falling intonation indicates 'abruptness', FR indicates a 'polite softening'. In the case of superlatives and comparatives, fall indicates 'enthusiastic agreement', while FR signals disagreement or at least amendment; e.g.,

(14) A: Do you want a glass of water? (= Ladd's ex. 19)
B: I'll have a \beer/.

Ladd paraphrases B's response as: 'You offered me something to drink—how about a beer instead of water?' With falling intonation, the response would have 'a rather abrupt feel, because in addition to saying no it makes a specific request without any other polite softening' (155). However, Ladd fails to explain how 'focus within a given set' either achieves this 'polite softening' effect or signals disagreement/amendment.

Although we agree with Ladd's general goal of assigning a context-independent interpretation to FR, certain problems remain with his analysis. First, a referent may, and often must, be interpreted as a member of some set even WITHOUT FR intonation in order for an exchange to be coherent. Despite the absence of FR over *cat* in 15, A must still recognize a set–member relationship between *animals* and *cat* to interpret B's response:

(15) A: Did you feed the animals?
B: I fed the \cat.[15]

Second, falling intonation need not indicate any 'newer' or 'less predictable' information than does FR. In both 16a and 16b, A must infer the set of which *champagne* and *mail* are members:

(16) A: Do you have champagne?
a. B: I have your \mail/.
b. B: I have your \mail.

Both FR AND falling intonation require that A seek such a relationship. In both utterances, *mail* may constitute equally 'new' (or 'old') information in the discourse. Therefore the conveyance of some particular information status does not serve to distinguish FR from falling intonation.

Third, Ladd's analysis fails to account for the inappropriateness of FR even when a set–member relationship can be easily perceived. In 17, FR is infeli-

[15] We use \x to indicate falling intonation over x.

citous, despite the fact that the set {*boy, girl*} has been explicitly evoked:[16]

(17) A: Did they have a boy or a girl?
B: #They had a \boy/.

Fourth, Ladd's claim that the primary purpose of FR is to relate some entity to a set in the context fails to explain cases in which FR does NOT mark an item's membership in a set. In 18, FR occurs over the set *people*—NOT over a member of the set:

(18) A: Are you sending me mail?
B: I'm sending \peo/ple mail.

In other cases, FR may occur when the relevant ordering relation evoked is not simple set inclusion at all. Consider the following exchange between passenger and bus driver:

(19) A: Do you go straight up Walnut?
B: To Thirty-\fourth/.

Here it is not the membership of *Thirty-fourth* in a set of streets that allows felicitous FR, but rather its position in a linear ordering of streets. If B knows that Walnut ends at Thirty-fourth, FR is inappropriate, even though Thirty-fourth can still be seen as a member of a set of streets. Ladd (156) attempts to account for related phenomena by extending the concept of set to include comparatives and superlatives as 'hierarchical sets', on which a linear ordering must be imposed. But neither this notion of hierarchical sets, nor the simpler concept of set, can account for the appropriateness of FR in 7, 11, and 12. Thus Ladd's analysis requires two distinct relationships—sets and hierarchical sets—and even these two orderings are insufficient to account for all occurences of FR.

Gussenhoven (81–3) notes that the set–member relationship is not a necessary condition for FR. He believes that, in general, intonational meaning is a function of the speaker's COMMUNICATIVE INTENTIONS. For FR, one of his three basic tone types, the communicative intention is SELECTION, i.e. the speaker's selection of 'a variable from the background'. Although 'variable' is not defined, it is clear that Gussenhoven does not intend for it to be construed along the lines of Ladd's sets: 'the meaning "focus within a set" is, when it is there, the result of the fact that the fall–rise selects from the background, and that many things will be organized there in sets' (81). Gussenhoven defines BACKGROUND as 'the understanding [which speakers] think they have reached

[16] Bolinger (p.c.) has suggested that the use of disjunction in ex. 17 might be taken as an explicit denial that the items are to be viewed as members of a set; this would account for the infelicity of FR. However, we would argue that the disjuncts in 17 MUST constitute a set in order for this exchange to be coherent even with falling intonation. And there are disjunctions which do permit FR:

A: Have you had a morphology or phonology course?
B: I've had a mor\phol/ogy course.

What seems relevant for FR here is whether the *or* of the query is perceived as inclusive or exclusive: where *or* is seen as clearly exclusive, as in 17, FR seems infelicitous. When *or* is more plausibly interpreted as inclusive, as above, FR is more appropriate.

at any point in [the] process whereby participants strive towards some common understanding about a particular segment of the world' (13). This selection tone (FR) can involve either 'hearer-serving manipulation' or 'speaker-serving manipulation'; i.e., the tone can be 'for the benefit of the speaker or for that of the hearer' (16). Speaker-serving FR conveys: 'I select this V[ariable] from the background for my own benefit → I take note of the fact that this is (was) background.' Hearer-serving FR conveys: 'I select this V from the background for your benefit → I remind you of the fact that this is background.' While we agree with Gussenhoven that some V must be selected from the context, and that it need not be seen as a member of a set, his account provides no additional constraints on its selection; clearly, it is not selected at random. And, as Gussenhoven himself points out, other intonation contours perform this same selection function (see §4.2, below).

Thus, for authors like Halliday and Bolinger, FR conveys some type of speaker attitude. For others, e.g. Ladd and Gussenhoven, FR relates some discourse entity to other entities in the context. Despite the apparent disparity between such interpretations as 'up-in-the-airness' and 'focus within a set', such accounts can be seen as complementary. As an alternative to the discourse functions suggested in previous studies, we propose a more precise and comprehensive specification both of the attitude associated with FR and of the way in which a salient relationship between discourse entities provides the basis for that attitude.

We claim that a speaker's use of FR conveys uncertainty about the appropriateness of some utterance in a given context—specifically, about some salient relationship between discourse entities, including (but not limited to) Ladd's set-membership. While uncertainty per se is certainly not incompatible with Bolinger's 'up-in-the-airness' or Halliday's 'reservation', FR involves a particular type of uncertainty. Intuitively, it seems to indicate that a speaker is uncertain about whether his utterance is relevant to the discourse; e.g.,

(20) A: You have a VW, don't you? (= Ladd's ex. 18)
B: I've got an \O/pel.

Ladd's paraphrase, 'You asked about foreign cars (German cars, small cars, etc.)—is this close enough?' (154), reflects this intuition. More generally, one might be tempted simply to paraphrase FR as 'Does this count as an appropriate response?' and leave it at that; thus 'I've got an Opel—does this count as an appropriate response to your query?' might accurately paraphrase B's response in 20. However, paraphrasing the responses in examples like 6–7 with either 'Is this close enough?' or 'Does this count?' would be decidedly odd:

(21) A: How can anyone with any sense not like San Francisco?
a. B: #\Bill/ doesn't like it—is this close enough?
b. B: #\Bill/ doesn't like it—does this count as an appropriate response?

(22) A: Can you come in at 3?
a. B: #I \can/—is this close enough?
b. B: #I \can/—does this count as an appropriate response?

In fact, FR conveys a more general uncertainty than 'Close enough?' and a more specific uncertainty than 'Does this count?' However, before a more precise description of the uncertainty conveyed by FR can be presented, we must first introduce our notion of 'scale', which will provide the formal basis for this characterization.

3. A SCALAR ACCOUNT. We agree with Ladd that some salient relationship between discourse entities is a necessary condition for a speaker's use of FR, but we have found that a much broader range of relationships than set-membership can fulfill this condition. We now first introduce the notion of SCALE (formulated in Hirschberg 1984) to specify this range; then we propose a formal definition of scale, indicate how particular scales are evoked in context, and discuss constraints on their use.

3.1. DEFINITION OF SCALE. The relationships that provide the basis for the felicitous use of FR are just those that can be represented as PARTIAL ORDERING relations. A partial ordering R on a set B is a relation on B such that, for all $b_1, b_2, b_3 \in B$, either

(23) R is
  a. Reflexive: $b_1 \; R \; b_1$,
  b. Antisymmetric: $(b_1 \; R \; b_2$ and $b_2 \; R \; b_1) \rightarrow b_1 = b_2$, and
  c. Transitive: $(b_1 \; R \; b_2$ and $b_2 \; R \; b_3) \rightarrow b_1 \; R \; b_3$; or

(24) R is
  a. Irreflexive: $b_1 \not R \; b_1$,
  b. Asymmetric: $b_1 \; R \; b_2 \rightarrow b_2 \not R \; b_1$, and
  c. Transitive.

A relation satisfying 23 is 'is as tall as or taller than'; one satisfying 24 is 'is taller than'. Note that we can always start with a relation satisfying 24 and produce one satisfying 23 simply by adding an equality disjunct to the relation, as with the 'is taller than' relation. For simplicity's sake, we will employ the conditions in 24. A set B and a partial ordering R on it define a PARTIALLY-ORDERED SET, or POSET. This concept provides a formal definition for an intuitive notion of 'scale', allowing the ranking of discourse referents as VALUES on such scales. Although one may define posets on singleton sets, we exclude such posets from our definition. The only relationship which such posets can model is one of simple equality, and we have defined the notion of scale to capture relationships BETWEEN distinct values on scales.

A scalar value may refer to an entity, attribute, event, activity, time, or place—or to a set of such items. Intuitively, a property may be ranked with respect to some entity which exhibits it via an 'attribute of' relation: thus an event may be ranked with other events according to 'temporal precedence', or elements or proper subsets of a set may be ranked with respect to the set by an 'inclusion' relation.[17] Defining scales as posets allows us to accommodate

[17] For example, a set x may be accommodated in the notion of scale by viewing the ordering relation 'inclusion' defined either on x and its disjoint proper subsets, or simply on x and its elements. In either case, x is a higher value than any element or subset of elements y because y 'is included in' x; and each y_i is an alternate value with respect to every other y_j, $i \neq j$.

not only Ladd's simple sets, but also his hierarchical sets, by ordering such hierarchies from root to leaf. Scales may also be defined by other hierarchical and linear orderings, e.g. spatial or temporal orderings, stages of a process, and relationships of type/subtype, entity/attribute, or part/whole.

Using this poset definition of 'scale', two values b_1 and b_2 on S may be related to each other in one of three possible ways.[18] First, b_2 is HIGHER on S than b_1 iff $b_1 \; R \; b_2$. In such a case, b_1 is LOWER on S than b_2. Incomparable elements b_1, b_2, which share a common higher or lower value b_3, we term ALTERNATE values on S.[19]

The possible orderings of b_1 and b_2 on S are illustrated in the constructed example 25, where b_1 is the queried value and b_2 is referenced in the response. Thus b_1 is lower than b_2 in 25a; b_1 is higher than b_2 in 25b; and b_1 and b_2 are alternates on S in 25c. Here the ordering 'is a part of' is defined on the set 'parts of a dissertation', and the scale is depicted in Figure 4.

(25) A: Did you read the first chapter?
  a. B: I read the first \half/ of it.
  b. B: I read the whole disser\ta/tion.[20]
  c. B: I read the \third/.

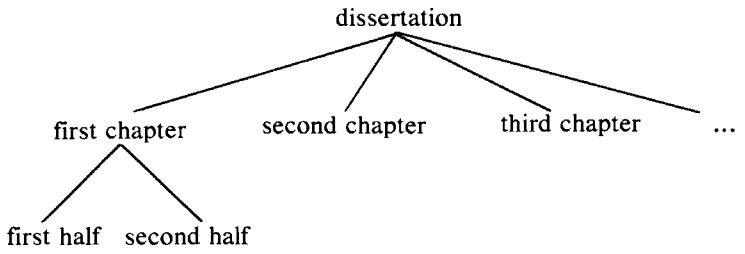

FIGURE 4.

The fact that some perceived scale is a necessary condition for FR is supported by the inference that hearers draw from this contour. Thus consider this constructed example:

(26) A: How do I get back to Manhattan from Roosevelt Island?
  B: You can take the \tram/way.

A here infers that B believes other modes of transportation between Manhattan and Roosevelt Island are available: i.e., he infers that a set of transportation options has been evoked. So, if B believes there is only one such option, his response will be misleading. Note that falling intonation would NOT induce this understanding.

[18] Note that, if we use the alternate definition of poset presented in 23, we must simply stipulate here that no value may be higher than, lower than, or alternate to itself; i.e., $b_1 \neq b_2$.

[19] Elements are incomparable if they are not ordered with respect to one another by R.

[20] This response may at first seem odd, but consider the following context: B wonders whether to interpret A's query as 'Did you read ONLY the first chapter?' or as 'Did you read AT LEAST the first chapter?' Responses referencing higher values are discussed in more detail in §3.3 and §4.1.

Second, not every ordering relation can support FR. Orderings which do not satisfy our definition of scale—e.g. cycles,[21] relations that are not transitive, and symmetric relationships—do not permit FR. In support of this claim, consider the cyclic relation evoked in this constructed example:

(27) A: Did you pass Go on that turn?
B: I got to Free \Park/ing.

Clearly the squares on a Monopoly board constitute a cycle; thus, in 27, 'getting to Free Parking' may or may not have involved 'passing Go.' In our terms, then, Free Parking could be considered to be both a higher and a lower value than Go, since one is spatially located both 'before' and 'after' the other. The ranking of these two items with respect to one another is therefore ambiguous, and A has no basis for interpreting B's response. Of course, if B perceives the relation of Free Parking to Go to be linear rather than cyclic, then FR is possible. Depending upon the salient portion of the cycle which A has linearized, B's response in 27 might be interpreted as 'Well, I not only passed Go, but I got as far as Free Parking—is that relevant?'; or 'Well, I didn't pass Go, but I did get to Free Parking—is that relevant?'

Similarly, if the relationship 'cousin of' is seen as symmetric (as in its normal interpretation), FR in the constructed 28 will be odd:

(28) A: Are you John's cousin?
B: #He's \mine/.

However, FR may be appropriate in this exchange if 'cousin of' is perceived as asymmetric. In fact, FR then induces such an interpretation, as we will discuss further in §4.3. Note also that, although the asymmetric relation 'ancestor of' permits FR in constructed example 29, a scale defined by the symmetric relation 'relative of' in 30 does not:

(29) A: Was Elizabeth I an ancestor of Henry VIII?
B: He was \hers/.
(30) A: Was Elizabeth I a relative of Henry VIII?
B: #He was \hers/.[22]

Since these exchanges differ only in the ordering relation involved, we claim that it is the scalar vs. non-scalar distinction that accounts for the difference in acceptability.[23]

Given our definition of scale, we can analyse (from a speaker's point of view) an utterance in which FR occurs as follows:

[21] A cycle is a finite chain of edges connecting vertices, v_1, ..., v_n, for which v_1 coincides with v_n and no other vertex is traversed more than once. That is, there is a path from v_1 to itself.

[22] Again, 'relative of' in another context might be perceived as asymmetric, thus licensing FR.

[23] We should note that, in 27–29, the corresponding utterance with falling intonation is equally odd unless a scalar relationship, as defined above, is perceived. A scalar relationship is in fact a necessary condition for other pragmatic phenomena as well (cf. Ward 1983, Hirschberg 1984). However, since these phenomena may occur without FR, they cannot be seen as additional or more inclusive prerequisites for it.

(31) a. Some proposition P becomes salient in the discourse.[24]
b. A value b_1 referenced by the utterance of P is perceived as salient (P then can be represented as $P(b_1)$).
c. b_1 is perceived as lying on some scale S.
d. $P(x)$ then represents the open proposition formed by substituting a variable x for b_1 in $P(b_1)$.
e. A speaker instantiates $P(x)$ with some b_2 that co-occurs with b_1 on S (and may be identical with b_1).
f. The resulting $P(b_2)$ is affirmed or denied by the speaker with FR intonation.

For example, in 32, b_1 is the set of all credit cards:

(32) A: Do you take credit cards?
B: Visa and \Mas/terCard.

But b_2 is a proper subset {*Visa, MasterCard*}; and thus it is a lower value on a scale defined by an inclusion relation. In 32, the salient scale is inferred from a mentioned higher value; but scales may also be inferred from lower or alternate values; e.g.,

(33) A: Have you, me, and Ellen ever had dinner together?
B: We've had \lunch/.

Here a higher value {meals} must first be inferred from b_1 which is *dinner*, in order for B to instantiate $P(x)$ with b_2 to form $P(lunch)$. In this example, b_2 and b_1 are alternate values on a scale defined by inclusion.

3.2. IDENTIFYING SCALAR VALUES. So far we have assumed that it is a straightforward matter for a hearer to identify a scale S evoked by the speaker—as well as the values that lie on S, i.e. b_1 (from the context) and b_2 (from the utterance with FR). However, the situation is more complex. For example, in 33, it seems clear that *dinner* represents b_1, while *lunch* is b_2, on a scale defined over 'meals.' But consider a modified version:

(34) A: Have you ever had dinner at Ellen's?
B: We've had lunch at the \Mid/town.

Will A (as hearer) perceive that *lunch* and *dinner* are values on a 'meal' scale, or that *dinner at Ellen's* and *lunch at the Midtown* are values on a scale defined over 'social events'? Or will A decide that *Ellen's* and *the Midtown* represent b_1 and b_2, respectively, on a scale defined over 'eating locations'? To identify what B has taken to be b_1 and S thus involves some non-trivial inference on A's part.

Despite this difficulty of identifying b_1 and S, it is possible to constrain the range of values and scales from which they have been chosen. We propose below a formal procedure for identifying the full range of potential b_2's for a particular utterance with FR. Once this range has been identified, we can limit the set of possible scales from which S has been chosen, since b_2 must lie on each scale in that set of scales. Working backward in the algorithm presented

[24] E.g. via assertion, or as the desideratum of a query or imperative.

in §3.1, we see that, by substituting a variable x for b_2 in P_{b_2}, we can identify the open proposition $P(x)$. By comparing $P(x)$ with the proposition P_{b_1}, we can thus determine b_1. And by searching for scales on which b_1 and b_2 co-occur, we can arrive at the set of possible salient scales from which the speaker has chosen S. Thus the identification of b_2 indirectly helps in the identification of S.

Recall that SYL can occur within any lexical item of the sentence. It might seem, then, that we could simply map the semantic interpretation of this lexical item LEX to some scalar value b_2. This is sometimes true—e.g., *lunch* can be mapped to b_2 in 33—but the process of identifying b_2 may be less direct. We must sometimes look at a string containing items besides LEX, in order to identify b_2. Thus *lunch at the Midtown* might represent b_2 in 34, where only *Midtown* is LEX. The problem is: How do we identify this string, given that SYL is restricted to a single lexical item?

To illustrate the scope of this problem, consider B's response to these constructed queries:

(35) a. A. Did liberals in southern Oregon vote for Hart?
b. A: Did liberals in the West vote for Hart?
c. A: Did liberals anywhere vote for Hart?
d. A: Did anybody vote for Hart?
B: Liberals in southern Cali\for/nia voted for Hart.

In this response, SYL is contained in *California*, which therefore constitutes LEX. But only in B's response to 35a does it seem that b_2 can be identified on the basis of LEX alone; in this case, *California* identifies a value 'California' that appears on a scale defined over the set 'US states' and its proper disjoint subsets (including 'California'). Thus LEX points us to the identification of 'California' as b_2. If B's response is to 35b, however, then it appears that we should look at the string *southern California* to identify the b_2 of B's response. This string appears to pick out a value on a scale of 'parts of the western US'. In response to 35c, *in southern California* appears to identify b_2: in this case, b_2 is a value on a more general scale of locations of US voters. Finally, in response to 35d, b_2 is a value on the scale of US voters, and is identified by the string *liberals in southern California*. Thus the range of possible values b_2 for B's response in 35 includes at least these four distinct strings.

From 35 it seems that a constituent analysis is the key to identifying b_2. The strings that identify various possible b_2's in 35 may be associated with the syntactic constituents they comprise. Thus *California* is a N, *southern California* a NP, *in southern California* a PP, and *liberals in southern California* a $_{\text{NP}}$[NP PP]. This constituent, whose semantic interpretation corresponds to b_2, we will call c. Note that, in 35, each possible c dominates LEX, i.e. *California*. In B's response to 35a, c is the N that immediately dominates LEX. However, in response to 35b–d, c is some larger constituent which dominates that N.

In 35, c is restricted to those constituents that dominate LEX; but any constituent (below the root S) that dominates LEX is a possible c, depending upon

context. However, in other examples, although possible c's are still restricted to those constituents dominating LEX, not every such constituent is a possible c. For example, whatever the query that precedes B's response in 36, only the NP that immediately dominates LEX (*Liberals*) can identify b_2:

(36) B: \Lib/erals in southern California voted for Hart.

Here b_2 may be some value on a scale defined over 'voters in southern California'. Moreover, this response could NOT be a felicitous response to any of the queries in 35. Similarly, in 37, where LEX is *southern*, only the ADJ that dominates LEX can identify b_2 regardless of the query:

(37) B: Liberals in \south/ern California voted for Hart.

In both these examples, while other constituents clearly dominate LEX, c is restricted to those constituents that IMMEDIATELY dominate it.

To account for this asymmetry in our findings, we draw upon the relational theory of stress presented by Liberman & Prince 1977, in which stress is analysed as a binary feature with only the values W(EAK) and S(TRONG). Thus Liberman & Prince's rules would assign values to the sentence *Liberals in southern California voted for Hart* (uttered with neutral intonation) as in Figure 5, where R labels the root of the tree.

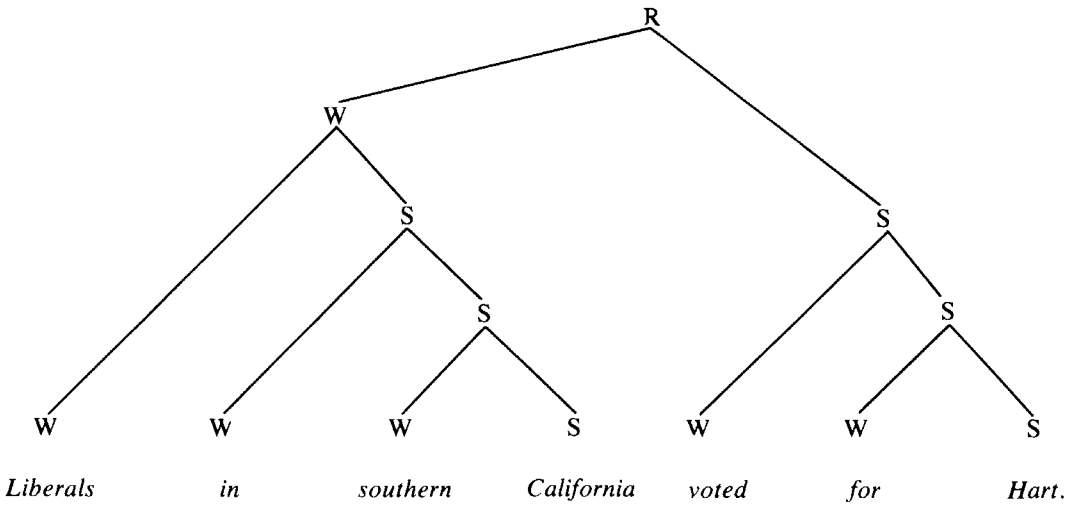

FIGURE 5.

Assuming some mapping between syntactic and prosodic trees, this structure can be used to determine C—the set of nodes in the prosodic tree corresponding to constituents c in the syntactic tree—in the following way:

(38) For any sentence S_1 corresponding to an utterance in which FR occurs, determine LEX by identifying SYL.

(39) Find the sentence S_2 corresponding to the utterance of S_1 with neutral intonation.

(40) Determine the prosodic tree for S_2.

(41) Traverse the shortest path from the node immediately dominating LEX

to R. For each $Node_i$ in this path (where i indexes the nodes from LEX to R):

a. If $Node_i$ is W, add the subtree rooted at $Node_i$ to C, and end the traversal;

b. If $Node_i$ is S, add the subtree rooted at $Node_i$ to C, and test $Node_{i+1}$.

(42) Each of the prosodic subtrees in C yields a possible determinant of the scalar value b_2.

This algorithm accounts for the limitations on possible c's for utterances in which FR occurs. In 36, since *liberals* in S_2 is immediately dominated by a W node, the traversal defined above will end with the testing of this first node on the path to R; thus only the subtree rooted at this node will be in C. Similarly, in 37, only the node immediately dominating *southern* can serve as c. However, in 35, no W node is encountered in the traversal until the trees corresponding to *California, southern California, in southern California*, and *liberals in southern California* have been added to C. Thus four nodes are added to C for this utterance, corresponding to the four constituents which, as we have seen, may serve as c.[25]

By using an independently motivated relational theory of stress, we can provide a straightforward account of the restrictions on those strings which can identify b_2 in an utterance with FR. Given these restrictions, we can at least identify the range of strings which may pick out a value b_2 for that utterance. Having discussed how we might narrow this range for a given utterance, we now turn to an examination of how the context—in particular, a preceding b_1 and the type of the sentence in which it occurs—might constrain a speaker's choice of a particular b_2.

3.3. CONSTRAINTS ON FALL–RISE? One might be tempted to define restrictions on FR based upon the relative position of b_1 and b_2 on S, or on the

[25] This analysis might be likened to accounts of other types of stress, such as that proposed by Culicover & Rochemont 1983. Working within the framework of the (Revised) Extended Standard Theory and adopting the Autonomous Systems view of Hale et al. 1977, Culicover & Rochemont claim that sentence FOCUS can be determined directly from a sentence structure enriched by an S-FEATURE assigned by their rule of STRONG assignment. However, their analysis of focus assignment does not account for the limitations on the range of possible c's noted above for FR. Their 'focal range' would predict that ANY constituent that dominates the S-feature defines a possible focus constituent (148). However, as we have demonstrated above, not every node which dominates LEX is a possible c. Even in cases involving simple contrastive stress, this account allows too broad a focal range. Thus Culicover & Rochemont's analysis would predict that contrastive stress on *in* below could focus the entire NP *liberals in California*, and thus make it an appropriate response to A's query:

A: Did conservatives vote for Hart?

B: #Liberals IN California voted for Hart.

Wilson & Sperber 1979 also discuss the role of stress in the derivation of the open proposition. However, their claim that 'use of heavy or contrastive stress ... seems to steer the hearer towards selection of one of the SMALLER possible constituents as focus' (315) does not appear generalizable to FR.

affirmation or negation of b_1 or b_2. For example, FR is rarely used over a b_2 taken to be a higher value on some S than b_1, as in this constructed example:

(43) A: Did you invite Bob?
B: ?I invited Bob and \Kar/en.[26]

However, recall 25b, in which *dissertation* references a higher value than *the first chapter*, and 18, in which *people* refers to a higher value than *me*. We have also observed that, when b_1 is negated, FR on b_2 will be more felicitous if b_2 is both affirmed and an alternate value of b_1, as in this constructed example:

(44) A: Didn't you invite Bob?
B: I invited \Kar/en.

With a negative b_1, FR over responses involving a negative or higher b_2, as in the following constructed examples, seems inappropriate:

(45) A: Didn't you invite Bob?
B: ?I didn't invite \Kar/en.
(46) A: Didn't you invite Bob?
B: ?I invited Bob and \Kar/en.
(47) A: Didn't you invite Bob?
B: ?I didn't invite Bob and \Kar/en.

However, though felicitous FR over such responses is rare, it does occur:

(48) A: It's not cool outside.
B: Well, it's not \warm/.

Thus, in principle, any ordering between b_1 and b_2 permits FR.

One might also be tempted to define the appropriateness of FR in terms of the illocutionary force of a prior utterance. We have few tokens of FR in response to WH-questions; e.g.,

(49) A: Which movie did you see last night?
B: *#Casa\blan/ca.*

Here, while *Casablanca* might be seen as a member of the evoked set {movies}, FR is distinctly odd. Though most of the examples we have presented show FR occurring in response to questions, and though most of these have been yes–no questions, the occurrence of FR is not restricted to any one utterance type: in 10 and 48, FR follows an assertion, and in 50 it follows a WH-question:

(50) A: Who in your department knows something about intonation?
B: No one I \like/.

To account for the infrequent occurrence of particular combinations of orderings and negation with FR, as well as its rarity in particular discourse contexts, one must consider the discourse function of FR. It is to this topic that we now turn.

4. THE DISCOURSE FUNCTION OF FALL–RISE. While a speaker's perception of some scale is a necessary condition for FR, we believe that its primary function is to convey a particular speaker attitude, namely uncertainty about the speaker's use of this perceived scale. Recalling our model of FR exchanges, we can

[26] We use ? to indicate questionable felicity.

classify this uncertainty into three types:

(51) I. Uncertainty about whether it is appropriate to evoke a scale *S* at all.
II. Uncertainty about which *S* to choose, given that some scale is appropriate.
III. Given some *S*, uncertainty about the choice of some value b_2 on *S*.

A speaker need not actually be 'uncertain' in order to use FR: it may be used to convey uncertainty for purposes of politeness, irony, or deference, as we discuss in §4.3. However, it can always be directly related to some aspect of the speaker's choice of scale and scalar value.

FR involves Type I uncertainty when the speaker wishes to convey doubt about whether, in a particular context, any scale at all is appropriate; e.g.,

(52) A: So you speak Sephardic?
B: Huh?
A: Do you speak Ladino?
B: I speak \Spa/nish.

Here B conveys uncertainty about whether A is interested only in Ladino, or whether other Iberian languages are also relevant. That is, B might wonder if a scale is relevant in this context. In 53, B conveys uncertainty about whether A is asking about Philip Roth novels in general, or *Portnoy's complaint* in particular:

(53) A: Have you read *Portnoy's complaint*?
B: I've read *Goodbye, Co\lum/bus*.

Is a scale defined over 'Philip Roth novels' salient? This type of uncertainty may also be conveyed by the negation of a queried value with FR over that value:

(54) A: Are you leaving today?
B: I'm not leaving to\day/.

Here B conveys uncertainty about whether a scale defined over 'departure dates' is salient: is A concerned only about whether B leaves today, or about the actual date of B's departure?

FR may convey Type II uncertainty about whether the particular scale the speaker has chosen is appropriate, given the many scales that might be evoked. In the constructed 55, for example, B conveys uncertainty about whether 'days of the week' (55a) or 'dates of the month' (55b) is salient to the exchange.

(55) A: The party is Friday the seventeenth.
a. B: \Fri/day isn't the seventeenth.
b. B: Friday isn't the seven\teenth/.

In the former, he chooses to form the open proposition 'X is the seventeenth'; in the latter, he forms the open proposition 'Friday is the Xth.' In each case, FR conveys uncertainty about whether the other open proposition would have been more appropriate. Similarly, FR may convey a speaker's uncertainty about whether the hearer will agree with him about how some scale is defined.

In 56, B may be uncertain about whether A perceives *vitamins* as a type of *medication*:

(56) A: Is she taking any medication?
B: \Vi/tamins.

That is, there may be some doubt for B as to whether A sees *vitamins* and *medication* as values on a scale ordered by a type/subtype relation.

Recall that scales are defined by both an ordering relation and a set of referents which that relation partially orders. Although, in 56, B conveys uncertainty about the set of discourse entities over which some scale is defined, this type of uncertainty may also involve doubt about the ordering relation defining the salient scale. In 28 (§3.1, reproduced below for convenience), we noted that FR may force an asymmetric interpretation of a relation normally seen as symmetric:

(57) A: Are you John's cousin?
B: #He's \mine/.

Under an asymmetric interpretation, B might convey uncertainty about the ordering relation 'cousin of' which relates B to John, and hence about the scale to be seen as salient: 'He may be my cousin, but I wouldn't want to be known as HIS.'

Type II Uncertainty may also be based upon linguistic ambiguity:

(58) A: Are you a doctor?
B: I have a Ph.\D/.

Here B conveys uncertainty about whether a scale defined over the set of medical doctors or of Ph.D.-holders is salient. Clearly, *doctor* might appear on both; hence the ambiguity.

This analysis can also account for a speaker's use of FR to convey uncertainty about whether two terms are coreferential, as in this classic example:

(59) A: Did you see the morning star?
a. B: I saw \Ve/nus.
b. B: I saw the \eve/ning star.

For B, the question is: Is b_2 on the same scale as b_1? I.e., is b_2 an element of the same set of referring expressions as b_1?

FR may convey Type III uncertainty when a speaker does not wish to convey doubt about the appropriateness or the definition of a chosen S, yet wishes to convey uncertainty about the position of b_2 on S; e.g.,

(60) B: I'm so excited. My girlfriend is coming to visit tonight.
A: From far away?
a. B: From suburban Phila\del/phia.
b. B: #From next \door/.

Here the speaker, a West Philadelphia resident, conveys uncertainty about whether, on a distance scale, *suburban Philadelphia* is *far away* from the speaker's location. Note that 60b is distinctly odd, given the implausibility of B's uncertainty about whether *next door* is *far away*. Similarly, consider this constructed example:

(61) A: Did she get a hundred on the midterm?
a. B: She got a ninety-\eight/.
b. B: #She got a \six/ty.

In 60a, B conveys doubt about whether two values are far enough apart; but in 61a, B might be uncertain about whether *ninety-eight* and *a hundred* are close enough (on the cardinal scale) for A's purposes. In contrast, 61b is odd just because the distance between *sixty* and *a hundred* (on a conventional grading scale) seems too great to warrant such uncertainty.

Type III uncertainty is also conveyed in 62, in which FR conveys doubt about whether Missouri is west of the Mississippi:

(62) A: Have you ever been West of the Mississippi?
B: I've been to Mis\sou/ri.

That is, B is unsure about the relative positions of *Missouri* and *the Mississippi* on a geographical scale ordered from east to west. In 63, B conveys similar uncertainty about whether *vinaigrette* is close enough to the requested *Italian* dressing:

(63) B: What kind of salad dressing do you want?
A: Do you have Italian?
B: Vinai\grette/.

It is important to note that—for all three types of uncertainty—wherever FR is appropriate, so are both falling intonation and A-rise. The semantic difference in each case is NOT that FR picks out a member of a set, or that FR selects a variable from the background; all three contours can do both. Similarly, both FR and A-rise may convey some sense of 'continuation' or 'incompletion'. What distinguishes FR is its discourse function: the conveyance of uncertainty. Speakers may use other linguistic forms to convey uncertainty, and they may use falling intonation or the A-rise contour to convey other attitudes. However, the use of FR commits a speaker to the conveyance of uncertainty. In fact, exx. 3, 17, 30, 43, 45–47, 49, 60b, and 61b are infelicitous or odd just because uncertainty in them is unwarranted. Note that, when falling intonation is substituted for FR, these examples become felicitous.

4.1. UNCERTAINTY AS A NECESSARY CONDITION FOR FALL–RISE. In §3.3, we argued against defining restrictions on FR in terms of the relative position of b_1 and b_2 on S and the affirmation or denial of b_1 or b_2. We noted that, although some combinations of relative position and polarity are rare, all are possible. Having identified the discourse function of FR, we are now in a position to explain why certain combinations occur more frequently than others.

We noted that FR rarely occurs when the new value b_2 is higher than b_1 on S. This infrequency follows from the requirement that FR convey uncertainty: it is usually odd to be uncertain about the relevance of mentioning a HIGHER value when a lower value has been evoked, as in 43. However, one may convey any of the types of uncertainty by mentioning a higher value; e.g.,

(64) A: Did you read Grice?
B: I read all the articles that were as\signed/.

Here B conveys Type II uncertainty about whether one value is in fact higher than another: does *all the articles that were assigned* include *Grice* on a scale defined by inclusion? What permits felicitous FR in 64 is the possibility that *Grice* may NOT be an element of 'assigned articles'. A speaker may also convey Type I uncertainty about whether a scale is appropriate at all by mentioning a higher value. Consider this constructed example:

(65) A: You need three dependents to get this deduction.
B: I have \sev/en.

Here B conveys uncertainty about whether a cardinal scale is appropriate in this context: Are exactly three dependents required for the deduction, or is a higher number permissible?

FR is also rare when b_1 and b_2 are identical and when both are affirmed. For example, B's response in the constructed 66 is coherent only in a context where B believes that A may actually be inquiring about a larger sum of money, e.g. the forty dollars that B owes A:

(66) A: Do you have twenty dollars?
B: I have \twen/ty dollars.

Again, we may analyse this uncertainty as doubt about the appropriateness of a cardinal scale. However, simple affirmation of a queried value usually precludes doubt about its appropriateness as a response.

Similarly, the concept of uncertainty provides an explanation for the apparent oddity of FR in certain utterance types. Recall that FR was infelicitous in 49 in response to A's WH-question. That infelicity can now be analysed in terms of the uncertainty conveyed by FR. It is difficult to imagine why B might be uncertain about the appropriateness of his response, since naming the movie *Casablanca* clearly satisfies A's query 'What movie ...' The fact that FR appears to occur more frequently in response to yes–no questions than WH-questions might then be explained as follows: WH-questions appear to define the set of possible appropriate responses more narrowly than yes–no questions, so they leave less room for uncertainty about whether some scalar value constitutes an appropriate response. Consider the difference between these constructed examples:

(67) a. A: Which movie did you see last night?
b. A: Did you see a movie last night?
B: We went for a \walk/.

In response to 67a, B's utterance seems deviant, because of the presupposition inherent in 67a—i.e. that some movie was seen. However, since 67b has no such presupposition, B may hypothesize that a response to the more general query, 'What did you do last night?', is appropriate. However, in the constructed 68, a WH-question very similar to 67a CAN be answered with FR:

(68) A: Which trashy movie did you see last night?
B: *Terms of en\dear/ment.*

Here B has grounds for wondering whether, for A, *Terms of endearment* is a type of *trashy movie.*

In further confirmation of this analysis, we observe that, while our corpus contains many instances of FR in indirect responses to yes–no questions, it contains no instance of FR co-occurring with a DIRECT response to such a question. While such responses may be possible, their absence from our corpus can also be explained in terms of speaker uncertainty. Given that FR conveys uncertainty about some scale or scalar value, it is unlikely that a speaker who can provide a direct *Yes* or *No* will at the same time wish to convey uncertainty about whether his response is appropriate. From the hearer's point of view, a *Yes* or *No* response to a yes–no question will generally represent a minimally adequate, although not necessarily maximally informative, response.[27] It seems that FR occurs precisely when speakers cannot, or do not wish to, commit themselves to direct responses. For example, in 69, B did not know whether her cat liked all flavors of Bonkers cat treats, and thus could not provide a direct response:

(69) A: So, Leo likes Bonkers?
B: She likes \li/ver flavor.

In summary, it is uncertainty that constrains FR, not any particular utterance type.

In addition to the putative scalar and utterance-type restrictions examined above, Bing proposes another constraint on FR. In §1, we noted that the contour may contain multiple SYL's. Bing argues (190–92) that, when more than one nucleus (corresponding to our SYL) occurs in a single utterance, only the last may be given a set–member interpretation. For example, in 70a–c, she claims (206) that 'the contrastive interpretation is given only on the final intonation phrase and only in those cases where the boundary tone is not interpreted as a continuation rise':

(70) a. She's a \vir/gin, she \says/. (= Bing's ex. 79)
b. She's a \Mor/mon, I be\lieve/. (= Bing's ex. 82)
c. Alan's a good \bad/minton player, ap\par/ently. (= Bing's ex. 92)

Thus, for Bing, the contrastive interpretation does not apply to *virgin, Mormon*, and *badminton*.

However, when we interpret these examples in light of our analysis, we find that FR conveys uncertainty about both the items containing Bing's nuclei. Consider the following contexts for the sentences in 70:

(71) a. Do you think Jane is a nice girl?
b. Mary's very religious, isn't she?
c. I bet Alan's a real klutz.

Here 70a may convey uncertainty about both Jane's sex life AND about the degree of the speaker's commitment to the truth of the proposition that Jane is a virgin. Exx. 70b–c can be explained along similar lines.

Contra Bing, we claim that, in principle, there is no upper bound on the number of SYL's an utterance may contain; consequently, there is no upper bound on the number of scalar values about which a speaker may convey

[27] We omit from this generalization such indirect speech acts as *Can you pass the salt?*

uncertainty. E.g.,

(72) A: Uh, your bibliography showed more than one place where Strawson and Donnellan are reprinted.
B: \Straw/son was in \six/, I \think/.

In practice, however, it seems likely that, the more SYL's in an utterance, the more difficult that utterance may be to process, because of the greater number of scales evoked.

Thus relative position of scalar values, preceding utterance-type, and performance factors may all serve to disfavor the use of FR to some extent. However, as we have demonstrated, these apparent restrictions all follow from the more general constraint of speaker uncertainty.

4.2. DISTINGUISHING THE CONTRIBUTION OF FALL–RISE. Previous studies have attributed a variety of discourse functions to FR, in particular the disambiguation of scope-ambiguous sentences, the negation of the 'literal reading' of the utterance—and, in negative utterances, the affirmation of non-negated members of a salient set. We now argue that it is not FR, but context or other co-occurring linguistic phenomena, that perform these functions.

Both Ladd and Jackendoff claim that FR forces a narrow-scope reading:

(73) \All/ the men didn't go. (= Ladd's ex. 1)

Ladd accounts for this favored reading in terms of his 'focus within a set' (160): 'the quantifier is tagged as a subset—but there is no quantifier of which *all* is a subset, so the quantifier associates with the negative, and we get *not all*, which of course can be a subset of *all*.' For us, the narrow-scope reading in 73 would involve Type I uncertainty. In this example, FR may convey uncertainty about whether *all* is to be interpreted as scalar. In the context of a rehearsal for a men's choir, the choirmaster might ask his subordinate whether all the singers had attended some rehearsal. By uttering 73, the assistant might wish to convey uncertainty about whether the choirmaster was interested in a simple yes–no response, or whether he wanted to know what portion of singers had missed the practice.

Although our theory can thus accommodate Ladd's and Jackendoff's narrow-scope reading of 73, we contend that it is context, not intonation, which favors one reading over another. Clearly, context can favor a narrow-scope reading even WITHOUT FR. Consider modifying 73 by substituting falling intonation:

(74) George said that everyone had left for the game by five, but I know that all the men didn't go that early.

Moreover, we agree with Gussenhoven, contra Jackendoff and Ladd, that context can also favor a wide-scope reading WITH FR.[28] Consider this constructed example:

[28] In support of his claim, Gussenhoven (80) proposes the following context for 75b: If God says, 'But there must have been at least ONE man in Sodom who regularly went to the temple, and worshipped, and ...', then, if B is an angel, he might reply, 'Don't worry. \All/ the men didn't go. I TOLD you. I checked EVERYBODY.' For us, FR does not seem possible with wide scope here; but we accept his point in principle.

(75) A: The foreman wants to know which union meeting some of the men missed.
B: \All/ of the men didn't go to the last one.

Our notion of speaker uncertainty easily accommodates this wide-scope interpretation: 75 can be seen as an instance of Type I uncertainty. B wonders whether A simply wants to know which meeting at least some of the men missed, or whether, in our terms, he should evoke a quantifier scale (as he does). In sum, what disambiguates ambiguous sentences involving quantifiers and negation is context, not FR.

Even in negative sentences without quantifiers, FR does not play the disambiguating role that has been attributed to it. As noted in §2.2, in our discussion of Jackendoff, FR does not alter an utterance's presuppositions. In 76, the presupposition 'X has some change' follows from the context, not from FR:

(76) A: Can I get change for a dollar from you?
B: \I/ don't have any change.

However, if we change the context for B's utterance slightly, as in 77, B's response would have the corresponding negative presupposition, 'X does not have any change':

(77) A: I'm looking for the guy who didn't have any change for the washers.
B: \I/ don't have any change.

In these examples as well, it is the context and not FR that favors one interpretation over another.

Another function that we believe has been mis-attributed to FR is proposed by Cutler. In arguing against the notion of context-independent intonational meaning, she offers the following counter-example to Ladd's context-independent notion of focus within a given set:

(78) A: How do you like my new color scheme? (= Cutler's ex. 22)
B: Not \bad/.

Cutler claims (112) that 'the result of applying [FR] is to negate the literal reading of the utterance and convey instead the speaker's opinion that the color scheme is not good.' She argues that the alleged discrepancy between 'literal reading' and 'conveyed meaning' is evidence that intonation does not provide a context-independent contribution to utterance interpretation. We would argue that Cutler is mistaken in her interpretation of 78: B's response of *not bad* is NOT equivalent to *good*. Her equation would be valid only for non-gradable, complementary attributes such as *dead/alive, pregnant/non-pregnant* etc. Clearly *good/bad* can represent poles on a continuum of values. In our analysis, B would be conveying Type III uncertainty about which value—higher than *bad* on the 'quality' scale—applies to A's color scheme. That is, the negative quality which Cutler attributes to this example does not result from FR, but rather from the scalar implicature which A is entitled to infer from B's response—i.e., that the higher value *good* is false or unknown to B (see Hirsch-

berg 1984). Hence the inference on A's part that B believes that the color scheme is not good.

Our corpus provides several counter-examples to Cutler's analysis; e.g.,

(79) A: [The photographs] are not very good though. The camera's lousy.
B: But they're not \bad/.

Cutler would presumably analyse B's response as 'But they're bad'; yet neither speaker nor hearer so interpreted this utterance. Consider another example:

(80) A: Is it false?
B: I think most people would say 'It's not \true/'.

An analysis like Cutler's would interpret B's response as 'I think most people would say "It's true"', which was not the understanding intended by B. Thus we conclude that FR does not negate the literal reading of the utterance.

Finally, Bing fails to distinguish between the contribution of FR and that of contrastive stress. In discussing the type of A-rise which we have identified as FR, she claims (189) that 'when an obvious contrast is possible, the interpretation of the A-rise contour will be one of contrast with something else in a possible set. In the case of negative sentences, the implied contrast is an affirmative statement.' In 81, she claims that it is the A-rise contour which induces the implicit contrast:

(81) He doesn't like his \teach/ers. (= Bing's ex. 73a)

Here the implied contrast is between *teachers* and the set of things *he* likes; thus, *he* likes something other than *teachers*.

However, as Gussenhoven (79–81) points out in arguing against Jackendoff's focus/presupposition theory, the same contrastive interpretation results from contrastive prominence in a falling tone. We can give 81 contrastive prominence on *teachers* and sentence-final fall, and get the same contrastive interpretation results WITHOUT FR:

(82) A: Is it true that Bill doesn't like his courses?
B: He doesn't like his TEACHERS.

In summary, the discourse function of FR can be reduced to the conveyance of speaker uncertainty. However, this uncertainty may in turn serve other discourse functions.

4.3. UNCERTAINTY WITHOUT UNCERTAINTY. A speaker may convey uncertainty with FR even when he is not actually uncertain about any aspect of b_1, b_2, or S, in order to achieve some social or rhetorical effect. Recall Ladd's example, repeated here, in which he claims that FR induces a 'polite softening effect':

(83) A: Do you want a glass of water?
B: I'll have a \beer/.

We may now reinterpret 83 in terms of speaker uncertainty. By using FR, B indicates that he does not assume that beer is available when only water has been offered—i.e., he is being 'politely uncertain' about how A may react to his positing that *beer* and *water* are elements of {available refreshments}. In fact, B may be fully aware that A's refrigerator is stocked with beer. Thus

Ladd's 'polite softening' is merely a secondary effect of the conveyance of uncertainty.

FR can also be used to achieve a humorous or ironic effect. Note that, in 28, B's response can be seen as ironic, given the unexpectedness of uncertainty about the symmetry of cousinhood. In 84 as well, FR achieves an ironic effect by casting doubt on X's membership in the set of linguists:

(84) A: Did any linguists come to the colloquium yesterday?
B: Well, \X/ did.

If B had not known X's field, she might have used FR out of simple ignorance. In reality, A and B both realized that X, while not technically a linguist, is often considered one, and B humorously used FR to convey uncertainty about X's true profession. In effect, B conveyed 'X attended, but do you consider her a linguist?'

While we make no attempt to exhaust the possible effects that may be achieved via FR, we would claim that each of them must ultimately derive from its fundamental discourse function of conveying speaker uncertainty. It now remains for us to determine how this contribution fits into a broader theoretical framework.

5. FALL–RISE AND PRAGMATIC THEORY. Our analysis of the FR intonational contour leads us to take issue with Cutler's claim (106) that 'even the non-specific, non-referential effects exercised by intonation contours can be shown to be context-dependent to such a degree that the attempt to extract from them an element of commonality valid in all contexts must be reckoned a futile endeavor.' On the contrary, our findings support Ladd's view that intonation makes an independent contribution to utterance interpretation. We have demonstrated how FR interacts with knowledge representation and discourse context, how this interaction is constrained, and how particular understandings result. Clearly such understandings are part of the over-all interpretation that a speaker derives from the utterance. How then do we characterize this interpretation?

While the contribution of FR may be an independent one—i.e. a contribution that is not dependent upon any particular lexical item(s) for its interpretation—we question whether this contribution is, strictly speaking, semantic, as most have assumed. If we follow the tradition of restricting semantics to those aspects of meaning that are defined truth-conditionally, then clearly the contribution of FR is not semantic. Some have proposed that FR does affect truth conditions; but we have argued above, in §2 and §4.2, that such claims cannot be maintained.[29] So, for example, in 85, B's last response is true if and only if it is true that B's cousin 'can sing a Motels song right now':

(85) A: Can you sing a Motels song right now?
B: Now?
A: Yeah.
B: My \cou/sin can.

[29] Even if presupposition were viewed as a semantic phenomenon (contrary to most current analyses), this would not affect our claim. As we have shown in §2, the presuppositions of a sentence are not altered by FR.

FR does not affect the truth conditions of this proposition. The same holds for the other examples discussed above.

Given a truth-conditional view of semantics, then, the 'meaning' of FR is not semantic. However, if by MEANING one intends 'an understanding which a hearer can be expected to derive', then FR does have a meaning, one which conveys a particular attitude of the speaker. The debate over whether intonational contours have context-independent meaning may thus be subsumed under the more general question of where the boundary between semantics and pragmatics should be drawn.

We propose that the understanding conveyed by FR can be accounted for in a straightforward manner as a type of CONVENTIONAL IMPLICATURE in the sense of Grice 1975, 1978.[30] Implicatures are those aspects of utterance interpretation which make no contribution to the truth conditions of a sentence, but constrain its appropriateness in discourse. There are two relevant diagnostics for a conventional implicature. First, it must be DETACHABLE; i.e., it will not necessarily be conveyed by distinct, truth-conditionally equivalent expressions. Thus 86b does not convey the implicature conveyed by 86a, namely that *John* was an unlikely person to leave:

(86) a. Even John left.
b. John left.

Second, conventional implicature cannot be CANCELED; i.e., it cannot be denied without producing an apparent contradiction. Ex. 87 is infelicitous in that the final sentence appears to contradict the causal link conveyed (implicated) by *therefore*:

(87) #He is an Englishman; he is, therefore, brave; however, his being brave does not follow from his being an Englishman.

These features also characterize FR. As shown in 85, FR makes no contribution to the truth conditions of an utterance: as we have also demonstrated in §4, FR constrains an utterance's appropriateness. The contribution of FR is also detachable: we have demonstrated above that it is always possible to substitute falling intonation for FR—the only difference produced is the failure of falling intonation to convey uncertainty. Thus a distinct, truth-conditionally equivalent utterance (the equivalent utterance with falling intonation) fails to convey the implicature associated with FR. Finally, the contribution of FR is not cancelable. In 88a, B's response may convey Type I uncertainty about whether a scale is appropriate in this exchange, i.e. whether desserts other than *jello* are of interest to A:

(88) A: Do you have jello?
a. B: We have \pie/.
b. B: #We have \pie/, which we know you won't eat.
c. B: We have \pie, which we know you won't eat.

[30] Grice (1978:121–3) suggests that some stress might be regarded as a means of conveying implicatures. Although he believes this interpretation holds for what Bing (147) would term 'default accents', he is unsure about whether it can be extended to cover other types of stress. Culicover & Rochemont, in passing, suspect that 'particular contours define conventional implicatures' (126, fn. 3); but they do not go on to investigate this possibility.

However, in 88b, B's response would be contradictory; the second clause would cancel the uncertainty implicated by the first. Similarly, in 89a, B's use of FR conveys uncertainty about whether a dime will satisfy A's request; but in 89b, *You're in luck* conveys that B is certain that it will:

(89) A: Do you have a nickel?
a. B: I have a \dime/.
b. B. #You're in luck—I have a \dime/.
c. B: You're in luck—I have a \dime.

Note that both 88c and 89c are felicitous with falling intonation on *pie* and *dime*. We conclude that the uncertainty implicated by FR is neither cancelable nor non-detachable, and that the understandings induced by FR are conveyed by conventional implicature.

Given that the contribution of FR is not part of the propositional content of an utterance, it is easy to see why some have rejected a context-independent semantic interpretation of intonation in general. However, rather than concluding that intonation cannot in principle be assigned an independent interpretation, we propose that at least some intonation be viewed as conventional implicature. More sophisticated semantic theories may eventually define this phenomenon as semantic; however, in the current Gricean framework, conventional implicature—and thus FR—lies clearly in the domain of pragmatics.

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