Speech Prosody 2016
31 May - 3 Jun 2106, Boston, USA

Epistemic and attitudinal meanings of rise and rise-plateau contours

Joseph C. Tyler [1], *Rachel Steindel Burdin*[2]

[1]Morehead State University
[2]The Ohio State University
josephctyler@gmail.com, burdin.2@osu.edu

Abstract

This paper investigates the epistemic and attitudinal meanings of rise and rise-plateau contours in listing contexts. Previous accounts of list intonation have made claims about epistemic meanings for list intonation, though without experimental evidence. In our first study, a metalinguistic task, subjects perceived rise and rise-plateau contours in listing contexts as having epistemic but also attitudinal meanings. In our second study, participants interpreted rises and rise-plateaus differently in terms of what the speaker thinks the listener knows: the rise-plateau was perceived as the speaker thinking that the listener already knows the items in the list ("reminding"), while the rise was perceived as the speaker thinking that the listener does not know the items in the list ("informing"). In the third study, we manipulated whether the speaker did or did not think the listener already knew the list items (the result from Study 2) to see if this manipulation would affect the attitudinal meanings described in the metalinguistic tasks. While this context manipulation did not interact with contour type in predicting attitudinal meanings, subjects did perceive the rise-plateau contour as more condescending, and less helpful, than the rise contour. In addition, the male speaker was rated as sounding more condescending, and less helpful, than the female speaker.
Index Terms: rising pitch, epistemic meaning, stylized intonation

1. Introduction

Lists come in a variety of types, contrasting in informativity (whether each enumerated element is individually meaningful or whether they are just representative of a larger category) [1] and exhaustivity (whether or not the list enumerates every relevant member of the category) [2, 3, 4], among other types. Some work focusing on prosodic disambiguation of list types (e.g., between exhaustive and non-exhaustive lists) have focused on the presence or absence of a medial falling phrase accent [5] or final fall [3, 4], with some positing a connection between this pattern and the intonational patterns found on alternative questions [2]. Ladd [1] focuses on the informativity contrast, and proposes that this contrast can be signaled by using either a "stylized rise" (a rise-plateau) or a simple rise on each item, with rise-plateaus being used on lists with uninformative items, and rises on lists with informative list items. For example, rise-plateaus can felicitously be used when listing schools in the area that are closed due to snow only if all or nearly all the schools are closed, meaning that the presence of any one school in the list is not particularly informative.

This claim– that rise-plateaus can be used to indicate uninformativity of list items–has not been tested experimentally, nor has there been further work generally exploring the meaning(s) of rise-plateau contours in lists. In this paper, we collect metalinguistic judgments about the meanings of rises vs. rise-plateaus (Study 1) in listing contexts. Then, we experimentally test effects of the rise vs. rise-plateau contours on judgments of speakers' and listeners' knowledge states (Studies 2a and 2b) and attitudes (Study 3). We introduce a methodology for experimentally exploring meanings of rise-plateau contours, and find that contour type affects perceptions of both epistemic and attitudinal meanings in listing contexts.

2. Studies

2.1. Study 1: Metalinguistic judgments of rises and rise-plateaus

In this study, listeners heard six pairs of lists, one with rises and one with rise-plateaus. We followed previous researchers in allowing "list" to cover not only collections of nouns (as in [6]) but also collections of actions (see, e.g., [1] pg. 529, [4] pg. 150). The scenario for each list was designed to be compatible with the speaker producing either an "informing" list (i.e., producing a list with individually informative items) or a "reminding" list (i.e., producing a list with non-individually informative items). An example scenario is given below in (1), with the target list items underlined. In this scenario, it is plausible that either (a) Mark and Stacie both know what goes in the bean dip, and thus, the individual ingredients aren't particularly informative, or (b) Stacie doesn't know what goes in the bean dip, and so each ingredient is informative. Throughout this paper, "speaker" refers to the speaker in the scenario (here, Mark), and "listener", the listener in the scenario (here, Stacie).

(1) Stacie is on her way to the grocery store, and calls Mark to ask if they need anything. Mark says:
(SOUND FILE: Oh! I'm going to make some bean dip! I need some beans, corn, peppers)

The lists were produced in two forms by speakers trained in ToBI annotation [7] (the authors), with either a rise (L* H-H%, top panel of Figure 1) or a rise-plateau (H* H-L%, bottom panel of Figure 1) on each item of the list. The full set of stimuli and recordings can be heard at `http://ling.osu.edu/~burdin/speechprosody.html`. The stimuli were made by concatenating either a rise or rise-plateau version of the list (e.g. "beans, corn, peppers" in (1)) to a single version of the pre-list material, effectively isolating the contrasting material to the list itself. As final falls have been claimed to be used to contrast exhaustive vs. non-exhaustive lists, neither list was produced with a final fall. This should help isolate the contribution of the rise-plateau and the rise. Subjects were told that the listener's phone died in the middle of the conversation, providing a potential explanation for the lack of a final fall and a reason for why

 doi: 10.21437/SpeechProsody.2016-27

the list may not sound completed. Since the same speakers produced all of the lists, the same names (Mark and Stacie) were used across all items; the information presented about Mark and Stacie was designed such that individual tokens did not contradict information in other tokens.

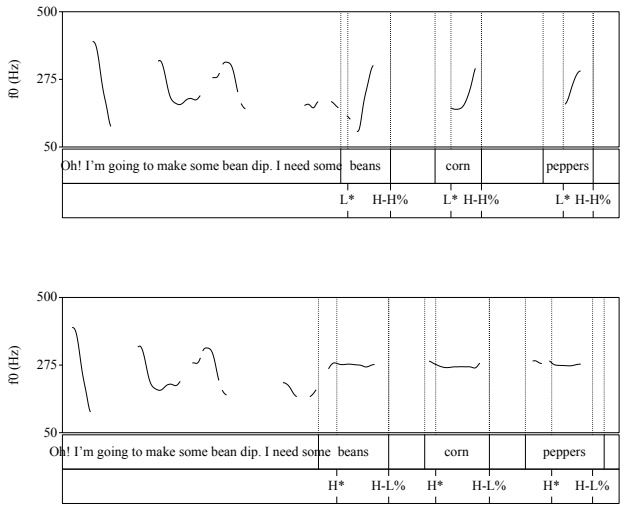

Figure 1: Rise and rise-plateau produced by female speaker

Twenty subjects recruited through Mechanical Turk (as they were for the rest of the studies) saw each of six scenarios and then listened to both lists, one with rises and the other with rise-plateaus. Subjects were asked to answer the question "What is the difference in meaning between the rise version and the high, flat version of the lists?".

In general, the simple rise was heard as unmarked ("simple list", "just her listing", "typical way of explaining something"). This unmarked usage was interpreted as informative or instructional ("just telling him what needs to be done", "giving instructions", "more educating tone"). The epistemic flavor of the rise meanings reflect a belief that the speaker thought the listener did not know the items in the list ("Mark assumes Stacie has no idea how to change a tire", "Stacie assumes that Mark has no clue what to do", "rise version is saying that Mark must not know what is in corn dip that Stacie makes").

The meanings ascribed to the lists with a rise-plateau were more diverse. These included meanings like the list not being fully planned ("seems to be her brainstorming it", "high, flat version implied that he wasn't sure as to the extent of the list, and was thinking of things to add as he listed them", "rattling a list off the top of his head") and uncertainty ("high, flat version implied that she wasn't sure as to the extent of the list", "he isn't really sure what the list should be"). Importantly, there were also epistemic interpretations: the rise-plateau conveys that the listener already knows, or should know, the listed items ("feels like this should be obvious and you know this", "this part is obvious", "assume that Mark knows the routes that she is talking about", "spoken in a manner that suggested the listener should already know what to do for the simple task"). The result is that the rise-plateaus are a reminding instead of an informing ("reminding Mark the ingredients she needs", "flat version is for someone who already knows what to do but is being reminded").

The epistemic meanings for the rise-plateau and the rise are quite similar to the meanings proposed by [1]: if the items in a list are "obvious" or something the listener should already know, then the items in the list are not particularly informative. However, if the items in the list are not known to the listener, or are not obvious, the items in the list are informative. It is this contrast between a rise informing the listener of something they don't already know and the rise-plateau reminding the listener of something they do already know that we examine in Study 2.

The participants also provided attitudinal meanings. The rise indicated "seriousness" and "deliberateness" on the part of the speaker, and was described as being "helpful", "friendly", and "less judgmental". The rise-plateau had more negative meanings overall, with the speaker described as "bored", "annoyed", "condescending", and "dismissive". These findings show that while linguists' introspection about the meanings of various contours can be accurate, they may be incomplete. We explore these attitudinal meanings, and possible relations between them and the epistemic meanings, in Study 3.

The question posted in the metalinguistic task, as well as the mere fact of presenting two separate contours, likely biased the participants towards giving differences between the lists (it should be noted, though, that in a couple cases, participants noted little, or no difference between the two). To ensure that these differences in meanings provided by the subjects were not artifacts of the task, the following studies (Study 2 and 3) test whether or not participants perceive a difference in the meaning of the two contours when presented in isolation.

2.2. Studies 2a and 2b: Epistemic meanings

In order to see if listeners have different epistemic interpretations for lists with rises vs. lists with rise-plateaus, as found in Study 1, but in a more controlled experimental context, a second study (Study 2a) was conducted. In this study, sixty participants heard one version (rise or rise-plateau) of twelve lists, the same six from Study 1 and six new ones. Both speaker (male or female) and contour type were counterbalanced across participants. Participants were given scenarios like in Study 1, along with, for each scenario, a yes/no question about whether the listener did know or didn't know the rest of the items in the list (e.g., "Does Stacie know what she needs to get?"). A "yes" answer indicates the subject thinks the listener already knows the items in the list (and is thus being "reminded"); a "no" answer indicates the subject thinks the listener does not already know the items in the list (and is thus being "informed").

As can be seen in Table 1, the contour type did not appear to have an effect on the subjects' answers. A chi-squared test revealed no significant effects of contour type on response ($\chi 2$= 0.2592, p= 0.61), and no further statistical modeling was done.

Table 1: Frequencies of judgments across intonation contour type in Study 2a.

	Yes (Knows)	No (Doesn't Know)
Rise	104 (41%)	148 (59%)
Rise-plateau	98 (39%)	153 (61%)

One possible explanation for this null result is that it asks about the listener's knowledge state, rather than the speaker's knowledge state: since the speaker is the one producing the con-

tour, and not the listener, the speaker's knowledge state, not the listener's, may be reflected in the speaker's choice of contour.

Study 2b was the same as 2a except the elicitation question was changed to query what the speaker thought the listener knew instead of just what the listener knew. To do this, sixty participants were asked to choose between two statements describing the speaker's knowledge of the listener's knowledge state; for the scenario in (1), for example, they were asked to choose between "Mark is pretty sure that Stacie knows what goes in the bean dip" ("know" response) and "Mark is pretty sure that Stacie doesn't know what goes in the bean dip" ("doesn't know" response).

A logistic mixed effects model was built with plateau type (rise or rise-plateau) and the speaker of the utterance (male or female), and interactions between the two as fixed effects, and the maximal random effects structure justified by the data; here, random intercepts by subject and by item. Contour type was found to be significant, with subjects hearing the rise-plateaus as indicating the speaker thought the listener already knew the items ($p < 0.001$; β= -0.990), as can be seen in Table 2. Speaker was not found to be significant.

Table 2: Frequencies of judgments across intonation contour type in Study 2b.

	Knows	Doesn't Know
Rise	76 (22%)	262 (78%)
Rise-plateau	144 (41%)	210 (59%)

2.3. Study 3: Attitudinal meanings

Our final study investigates the attitudinal meanings provided by the participants in the metalinguistic task. It was thought that some of these meanings might interact with the more epistemic meanings. For example, in a scenario where the listener knows the items on the list, but the speaker thinks that the listener does not know and then uses rises (the "informing" contour), the speaker might be heard as sounding condescending. On the other hand, if the listener truly doesn't know the list items, a speaker using rises could sound helpful. Additionally, these attitudinal meanings may interact with social meanings: a male speaker might be more likely to be judged as condescending (see, for example, the neologism *mansplaining* [8], a word coined to describe a situation in which a male speaker tells a female speaker something she already knows). Likewise, general stereotypes of women being more "nurturing" than men may explain higher "helpful" ratings for the female speaker.

Two versions of each scenario was developed. An example is given below: in one version (2), the scenario was set up such that the speaker had evidence of the listener having knowledge of the items in the list (in this example, since they often make the bean dip together); in the other (3), the speaker had evidence that the listener did not know the items in the list (in this example, since Mark found the new recipe when Stacie wasn't there). (2) will be referred to as the "know" condition, and (3) the "doesn't know" condition.

(2) Stacie is on her way to the grocery store, and calls Mark to ask if they need anything. Mark wants to make the special bean dip that he and Stacie have made together many times before.

(3) Stacie is on her way to the grocery store, and calls Mark to ask if they need anything. After Stacie left for the store, Mark found a new recipe for bean dip he wants to try.

Four new lists, along with pairs of associated scenarios, were added to the twelve used in the previous studies, for a total of 16 different lists. 106 subjects were recruited through Mechanical Turk. The design was cross balanced into 8 blocks so that subjects either heard (1) the male or female speaker, (2) the rise-plateau or the rise in (3) either the "know" condition or the "doesn't know" condition. Subjects were then asked to rate the speaker on four characteristics: helpful, condescending, tired, and excited on a five point Likert-type scale, with 1 being "not at all" and 5 "very much so". All four of these terms emerged in the results of the metalinguistic task (Study 1). "Helpful" and "condescending" were chosen as they might interact with the epistemic meanings as described above; "tired" and "excited" were used as distractor items.

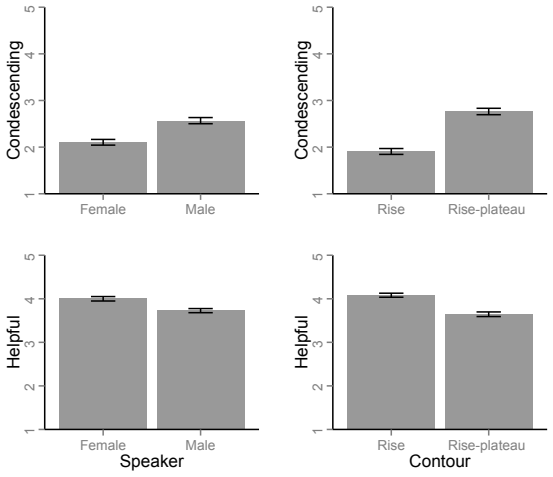

Figure 2: Mean ratings for "condescending" and "helpful", on a 5 point Likert-type scale, by speaker gender and contour type.

Cumulative linked mixed models were built using the ordinal package [9] in R predicting ratings for "helpful" and "condescending", with speaker (male or female), contour type, context ("know" vs. "doesn't know"), listener gender and up to three-way interactions between these items present as fixed effects, as well as the maximal random effects structure justified by the data. Deviation coding was used for all fixed effects. A step-down procedure using log likelihood comparisons was used to find the best models.

For "helpful", the best model had fixed effects for speaker and contour type, with random intercepts by item and by subject, and random slopes for contour type by subject. Speaker and contour both had significant effects, with the female speaker rated as sounding significantly more helpful than the male speaker ($p < 0.001$, β = 0.34662) and the rise sounding more helpful than the plateau ($p < 0.001$, β = -0.58691), as can be seen in the bottom two panels of figure 2.

For "condescending", the best model had fixed effects for speaker, contour type, context, and an interaction between speaker and contour type, with random intercepts by subject and item, and random slopes for both contour type and speaker gender. There was a significant effect of speaker ($p < 0.001$, β =

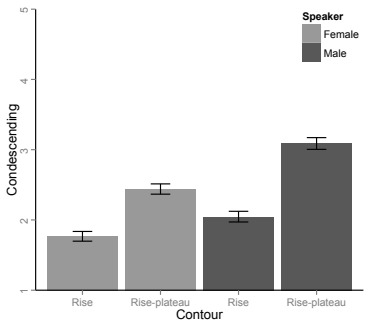

Figure 3: Interaction between speaker and contour type for "condescending" rating.

-0.48164), with the male speaker rated as sounding more condescending than the female speaker. There was also a significant effect of contour ($p<0.001$ β = 0.96812), with the rise-plateau rated as sounding more condescending than the rise. Both of these effects can be seen in the top two panels of figure 2. There was a significant interaction ($p<0.05$, β = -0.11226) between speaker and contour type, with the male speaker having greater differences between the rise and rise-plateau compared to the female speaker, as can be seen in figure 3. Finally, there was a significant effect of context (β = 0.11139, $p<0.05$), with the "know" condition rated as more condescending than the "doesn't know" condition. This effect was quite small (mean rating of 2.39 in "know" and 2.29 in "doesn't know").

3. Discussion and Conclusion

In study 1, many participants described the differences between the meanings of the contours as something similar to [1]'s notion of "informativity". Unexpectedly, the participants also provided many attitudinal meanings, with more negative meanings for the rise-plateaus, and more positive meanings for the rises.

Study 2 tested to see if the differences in epistemic meanings could be verified in contexts where participants only heard one of the contours. While Study 2a found no effect of contour type, Study 2b found that simple rises biased participants to believe that the speaker thinks the listener does not know the list items ("informing") and that rise-plateaus biased participants to believe that the speaker thinks the listener does know the list items ("reminding"). These results show that, at least in some circumstances, listeners can make use of intonation to distinguish between different epistemic meanings of lists. The study also shows that at least some subjects– those on Mechanical Turk– are able to answer questions looking at fairly complex epistemic meanings: in this case, those that require modeling two different people's knowledge states.

It should be noted in both studies 2a and 2b, there was an overall bias towards the "doesn't know" response. The setup of the contexts, in which the participants are explicitly given a situation in which one person is calling another for help, as well as the participants being explicitly told that the conversation is cut off, is more consistent with the situation where the listener does not know the list items than one in which the listener does know the items. However, there is still an effect of contour: in study 2b, while the rise-plateaus show this bias towards "doesn't know" answers (with 59% selecting "doesn't know"), this bias is considerably smaller than the one for the rises (with 78% selecting "doesn't know").

Study 3 looked into the attitudinal meanings expressed in the metalinguistic study, where overall the rise was rated more positively than the plateau, as sounding more helpful and less condescending. Although there may be other factors besides the contour in the speech signal affecting these ratings (for example, the intensity or duration of the list items), the fact that there were differences between the rise and rise-plateau for the ratings for "helpful" and "condescending" for both of the speakers suggest that contour is playing a significant role.

The more positive ratings for the female speaker (more helpful, less condescending), as well as the interaction between contour and gender for "condescending" (with the male speaker having a greater difference between the ratings for his rises and rise-plateaus) may be related to general stereotypes about male speakers (as a potential "mansplainer") and female speakers (as being more nurturing or helpful). Additionally, the positive evaluation of rises from the female speaker may also seem surprising in light of negative evaluations of "uptalk" that can be found in the media (e.g., [10]); however, other perceptual studies have similarly found positive, or at least, non-negative, evaluations of rises in female speech [11, 12]. As these judgements are only based on two speakers, further work with more speakers would be necessary to make any firm claims about the effects of gender.

The context manipulations done in study 3 affected the ratings for "condescending": if the speaker thinks the listener already knows (or should already know) the items in the list, actually listing the items in the list might come across as "talking down"; hence the higher ratings for "condescending" when the speaker knows that the listener already knows the items. However, this effect is quite small, and context did not interact with contour type in the predicted way: for example, the rise-plateau contour was not rated as sounding significantly more condescending in the "know" condition, and the rise-plateau contour was not rated as sounding significantly more helpful in the "doesn't know" condition. It is not clear why this is the case, and experiments with different context manipulations, or different prompts, may show different results.

The results from Study 1 provide evidence for the usefulness of gathering metalinguistic judgements from naive listeners in studying intonational meaning, as subjects provided meanings that aligned with linguists' previous analyses and also provided attitudinal meanings that had not been previously documented. The results from Study 2, in which subjects associated the rise-plateau with contexts where the speaker thought the listener didn't know the items in the list, and the rise with contexts where the speaker thought the listener did know the items, provides experimental support for the claims in [1]. Finally, study 3 shows how an intonation contour can affect the attitudes subjects have towards the speaker, with the rise-plateau sounding more condescending, and the rise, more helpful.

4. Acknowledgements

Thanks to Rory Turnbull for helpful discussion. This research was partially supported by an Institutional Development Award (IDeA) from the National Institute of General Medical Sciences of the National Institutes of Health under grant number 5P20GM103436-13 and by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number R15HD072713.

5. References

[1] D. R. Ladd, "Stylized intonation," *Language*, vol. 54, no. 3, pp. 517 – 540, 1978.

[2] T. E. Zimmermann, "Free choice disjunction and epistemic possibility," *Natural Language Semantics*, vol. 8, pp. 255 – 290, 2000.

[3] M. Schubiger, *English intonation, its form and function*. Tübingen, M. Niemeyer Verlag, 1958.

[4] E. Couper-Kuhlen, *An introduction to English prosody*. Hodder Arnold, 1986.

[5] J. Pierrehumbert and J. Hirschberg, "The meaning of intonational contours in the interpretation of discourse," in *Intentions in Communication*, P. Cohen, J. Morgan, and M. Pollack, Eds. MIT Press, 1990, pp. 271–311.

[6] M. Liberman and J. B. Pierrehumbert, "Intonational invariance under changes in pitch range and length," in *Language Sound Structure*, M. Aronoff and R. Oehrle, Eds. Cambridge, MA: MIT Press, 1984, pp. 157 – 233.

[7] M. E. Beckman and G. Ayers Elam, "Guidelines for ToBI labelling, version 3. the Ohio State University Research Foundation," www.ling.ohio-state.edu/\~tobi/ame_tobi/labelling_guide_v3.pdf, 1997.

[8] [Online]. Available: https://en.wikipedia.org/wiki/Mansplaining

[9] R. H. B. Christensen, "ordinal—regression models for ordinal data," 2015, r package version 2015.6-28. http://www.cran.r-project.org/package=ordinal/.

[10] H. Davis. (2010, October) The uptalk epidemic: can you say something without turning it into a question? [Online]. Available: https://www.psychologytoday.com/blog/caveman-logic/201010/the-uptalk-epidemic

[11] J. C. Tyler, "Expanding and mapping the indexical field: rising pitch, the uptalk stereotype and perceptual variation," *Journal of English Linguistics*, pp. 1 –27, 2015.

[12] V. Shokeir, "Evidence for the stable use of uptalk in South Ontario English," *University of Pennsylvania Working Papers in Linguistics*, vol. 14, no. 2, 2008.