On the meaning of intonational contours: a view from scalar inference

Introduction The intonational contour with which an utterance is produced plays a crucial role for the utterance's meaning (see e.g. Jeong 2018, Constant 2014). The present work investigates the meaning contribution of intonational contours in relation to scalar inferences (SI), and in relation to differences across scalar terms in the likelihood of SI —a phenomenon known as scalar diversity (i.a. van Tiel et al 2016). We present two experiments: one combining production with comprehension, and one testing the interpretation of auditory stimuli. The focus of both experiments was the rise-fall-rise contour (RFR, Ward & Hirschberg 1985), but results also revealed an as yet undescribed contour that we label the *Concession Contour* (CC). Our findings provide evidence against uncertainty/incompleteness accounts of the RFR (Ward & Hirschberg, Constant 2012) and in favor of the scalar account of Göbel (2019) and Göbel & Wagner (2022), who argue that the RFR indicates the presence of a higher alternative on a pragmatically determined scale.

Background Incompleteness accounts of the RFR are largely motivated by the contour's inability to be used with maximal points of a scale, (1). Formal analyses capture this data in similar ways: for Wagner (2012), as a presupposition that at least one alternative to the prejacent is assertable; for Constant (2012), as a conventional implicature that no assertable alternative - i.e. an alternative whose truth-value is unknown - can be safely claimed, in addition to disallowing vacuous quantification. Thus, there have to be alternatives left open as neither true nor false for the RFR to be felicitous, which is the case for *some* but not *all*. On this view, the RFR should be incompatible with drawing an SI, since the SI is the negation of a stronger alternative, and would thus be at odds with the requirement for some alternative to be left open. Similarly, if the RFR indicates uncertainty about other alternatives à la Ward & Hirschberg, an SI should also be less likely.

(1) A: Did you feed the cats? - B: I fed {SOME/#ALL} of them. [AUDIO: SOME, ALL]

These accounts face issues with two types of data. First, the RFR can be used when a stronger alternative is contextually resolved, (2). Second, the RFR exhibits a valence asymmetry: a positive reply to a negative statement is felicitous, but a negative reply to a positive statement is not, (3).

(2) A: Did you feed all ten cats? - B: I didn't feed all ten, but I fed NINE of them... (AUDIO)

(3) a. A: That was a really bothersome hike today. - B: It was sunny. [AUDIO]
b. A: That was a really enjoyable hike today. - B: #It was pouring. [AUDIO]

Based on these data, Göbel & Wagner (2022), following Göbel (2019), propose that the RFR merely indicates the presence of a higher alternative on a pragmatically determined scale (for (2) *ten cats*, for (3a) the hike being better than claimed). On this view, we might expect the RFR to make SI calculation more likely, since it would increase the salience of the relevant stronger alternative, which has been shown to increase SI rates (e.g. Degen 2013; Zondervan et al. 2008).

Exp1: Production + SI calculation Materials consisted of 60 question-answer dialogues that varied in whether the question prompt contained a stronger alternative (STRONG condition) or the same scalar term (SAME condition) as the target sentence, adapted from Ronai & Xiang (2022), see (4). Participants were shown the dialogues and listened to a recording of the question, then had to produce the target sentence. Afterwards, they answered *Yes* or *No* to a question probing the SI.

(4) Prompt: *Sue*: {Was the winner ecstatic? (STRONG) / Was the winner happy? (SAME) }
Target: *You*: She was happy.
Q: *Given your response, do you think Sue would conclude that the winner was not ecstatic?*

Predictions. First, we expected the SAME condition to encourage a prominence shift to the auxiliary (=Verum Focus, Höhle 1992), where possible, due to the scalar term being given. Second, the scalar account (Göbel & Wagner) predicts the RFR to be more likely in the STRONG condition, since in that context the relevant stronger alternative to license the RFR is explicitly given. Third, uncertainty/incompleteness accounts (Ward & Hirschberg, Constant) predict a decrease in SI rate for the RFR compared to "neutral" intonation, whereas the scalar account predicts an increase.

Results. Recordings (N=37) were manually annotated for four a priori categories ("Neutral" Fall, Verum Focus, RFR, Other/Unclear) in addition to one contour that initial data inspection revealed to be notably frequent. This contour, which we call the Concession Contour (CC), prosodically resembles the Contradiction Contour (Liberman & Sag 1974) but intuitively differs in its meaning (see (5) further below for an illustration). *Production Rates (Fig 1):* In line with the first two predictions, we found more Verum Focus in the SAME condition compared to STRONG and the RFR almost exclusively in the STRONG condition. *SI Rates (Fig 2):* The STRONG condition showed higher SI rates than the SAME condition (*glmer*, $p < 0.001$), replicating Ronai & Xiang (2022), but did not interact with contour (all $p > 0.3$). Crucially, we found a significantly higher rate of SI when participants produced an RFR compared to a "Neutral" Fall ($p < 0.05$). The CC showed an intermediate status, with more SIs than a "Neutral" Fall ($p < 0.001$), but less than the RFR.

Exp2: Perception + SI calculation Given the potential unusualness of evaluating an inference based on one's own production, this experiment had participants listen to prerecorded stimuli that varied in their contour, followed by an SI probing question. Materials were identical to Exp1 with the exception of being restricted to the STRONG condition, as the RFR (our main interest here) was rarely produced in the SAME condition, possibly due to unnaturalness. The tested contours were "Neutral" Fall, RFR, as well as the Concession Contour for exploratory purposes, see (5).

(5) *Sue*: Was the winner ecstatic? - *Al*: She was happy. {[NEUTRAL], [RFR], [CC]}
Q: *Given Al's response, do you think Sue would conclude that the winner was not ecstatic?*

Results (N=73) showed significantly higher SI rates with RFR than with "Neutral" Fall ($p < 0.01$, Fig. 3); though this difference was numerically smaller than in Exp 1, and the overall rates with "Neutral" Fall higher. A possible explanation for this discrepancy could be that participants were better able to tap into the intended meaning for their own production (Exp 1) than when reconstructing it from another speaker (Exp 2).

Discussion The experiments provide evidence in favor of the scalar account of the RFR and against uncertainty/incompleteness accounts: the RFR increased the rate of SIs both when participants judged their own production and when judging someone else's intonation, in line with prior findings by de Marneffe & Tonhauser (2019). Additionally, productions of the RFR were almost exclusively restricted to the STRONG condition, in line with the proposed licensing condition of the scalar account. The production data also revealed a contour that to our knowledge has not been discussed in the literature. While the CC resembles the RFR in showing increased SI rate, one notable difference is that the CC allows obviating restrictions on Givenness, as shown by its compatibility with either question prompt (Fig 1). We hope that a deeper investigation of the contours' distribution across scalar terms (see Fig 4) can yield further insights into their meaning contributions, which will be discussed in the presentation. Finally, the results raise a crucial methodological point about the study of SI: without details about (implicit) prosody, differences in SI rate may be mediated by the rate of RFRs or CCs, rather than directly caused by the examined factors. This highlights the importance of controlling for intonation in future investigations of SI.

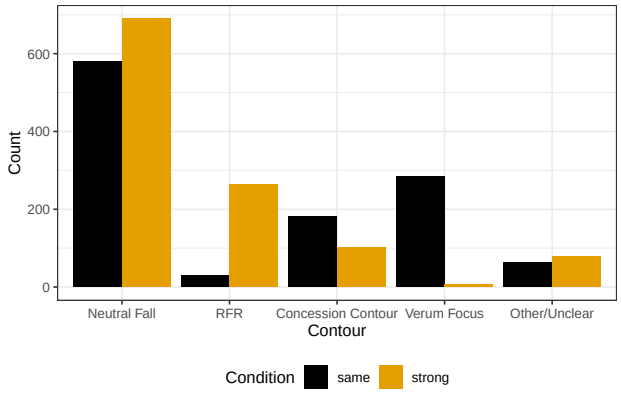

Figure 1: Production Rates by Prompt, Exp 1

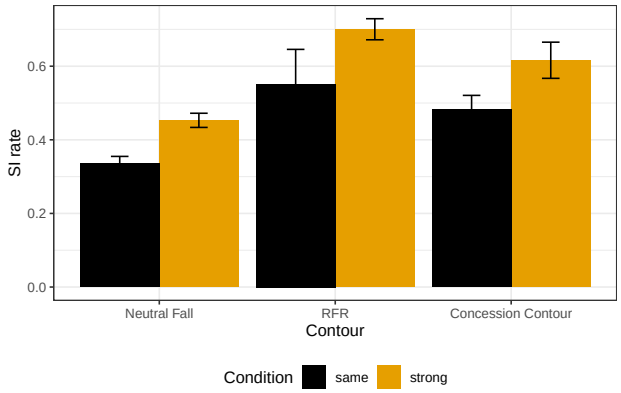

Figure 2: SI rates By Contour and Prompt, Exp 1

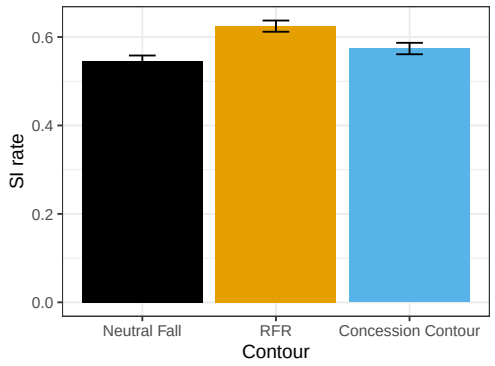

Figure 3: SI Rates by Contour, Exp 2

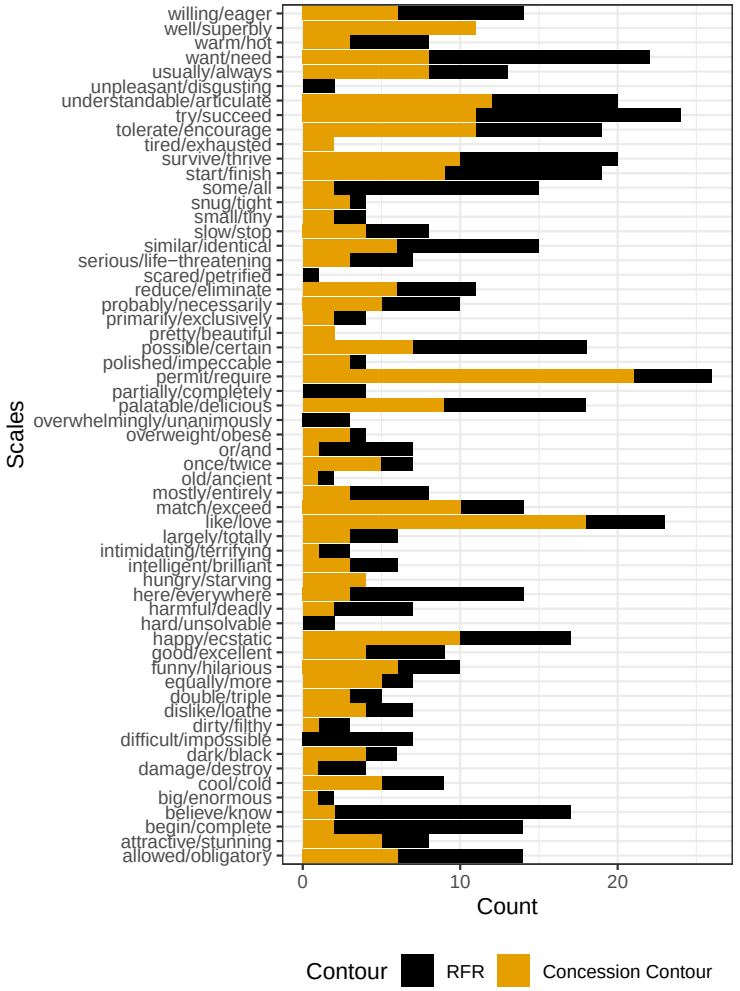

Figure 4: Production by Item, Exp 1

References: Constant (2012), *L&P* | Constant (2014), *PhD Thesis* | Degen (2013), *PhD thesis* | de Marneffe & Tonhauser (2019), In: *Questions in Discourse* | Göbel (2019), *SALT29* | Göbel & Wagner (2022), *ELM2* | Höhle (1992), In: *Informationsstruktur und Grammatik* | Jeong (2018), *JoS* | Ronai & Xiang (2022), *LSA2022* | van Tiel et al. (2016), *JoS* | Wagner (2012), *S&P* | Ward & Hirschberg (1985), *Language* | Zondervan et al. (2008), *SALT18*