Testing the Locus of Speech Act Meaning in English Intonation

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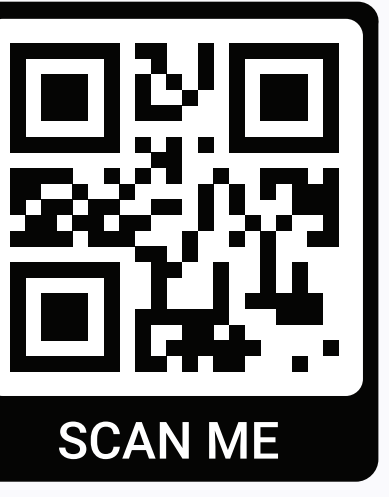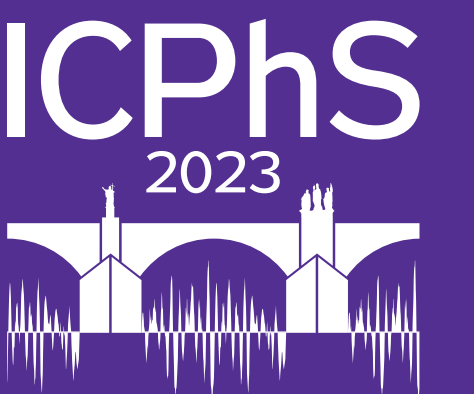
Background

Pierrehumbert and Hirschberg (1990)
Farkas and Bruce (2010)
Farkas and Roelofsen (2017)

Falling and rising declaratives in American English typically convey either an **assertion** or a **question**, respectively

Jeong (2018)

Shallow rises are more likely than steep rises to be interpreted as an assertion, but is this a phonological contrast in the pitch accent or phonetic variation in the scaling of the boundary tone?
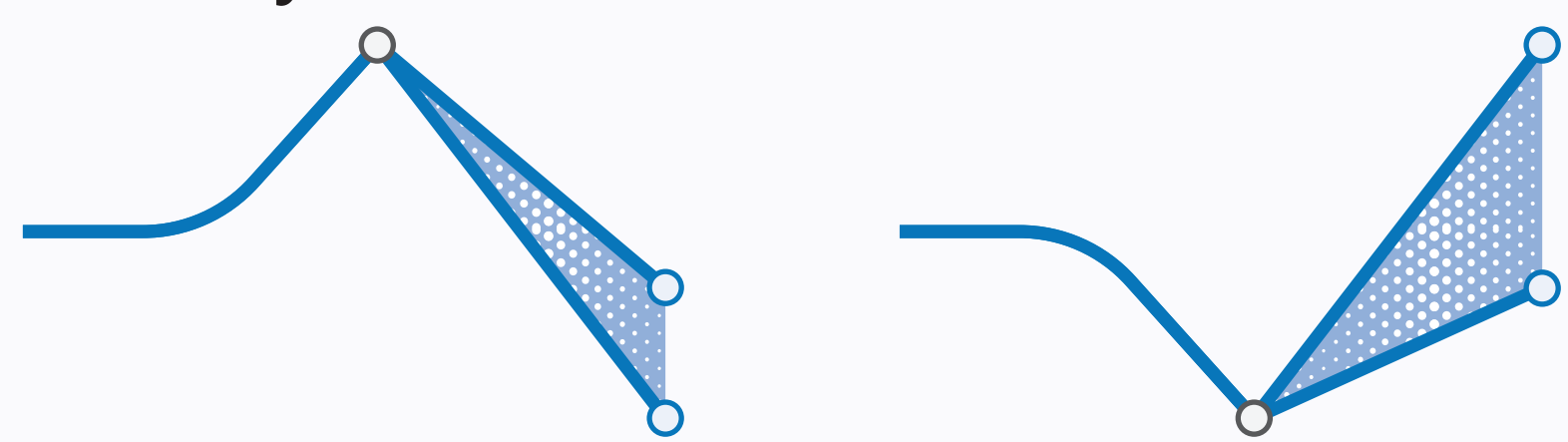
Barnes et al. (2012;2021)

Tonal Center of Gravity reflects the weighted overall pitch for a time span

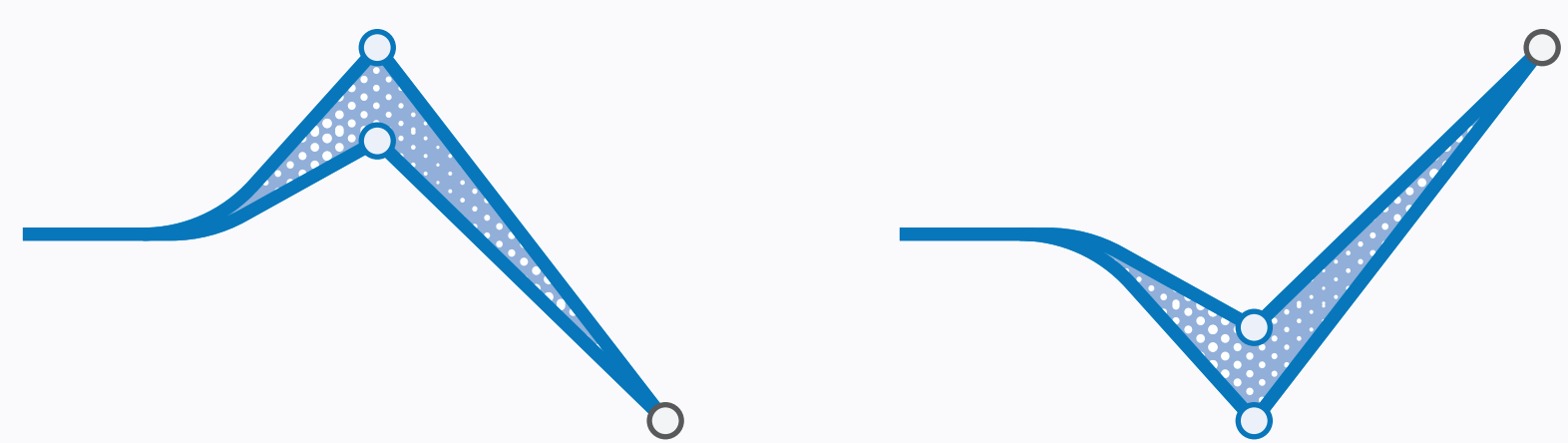$$TCoG = \frac{\sum_i F0_i\, t_i}{\sum_i t_i}$$

Questions

Which part of the contour matters when interpreting a declarative utterance as an assertion or question?
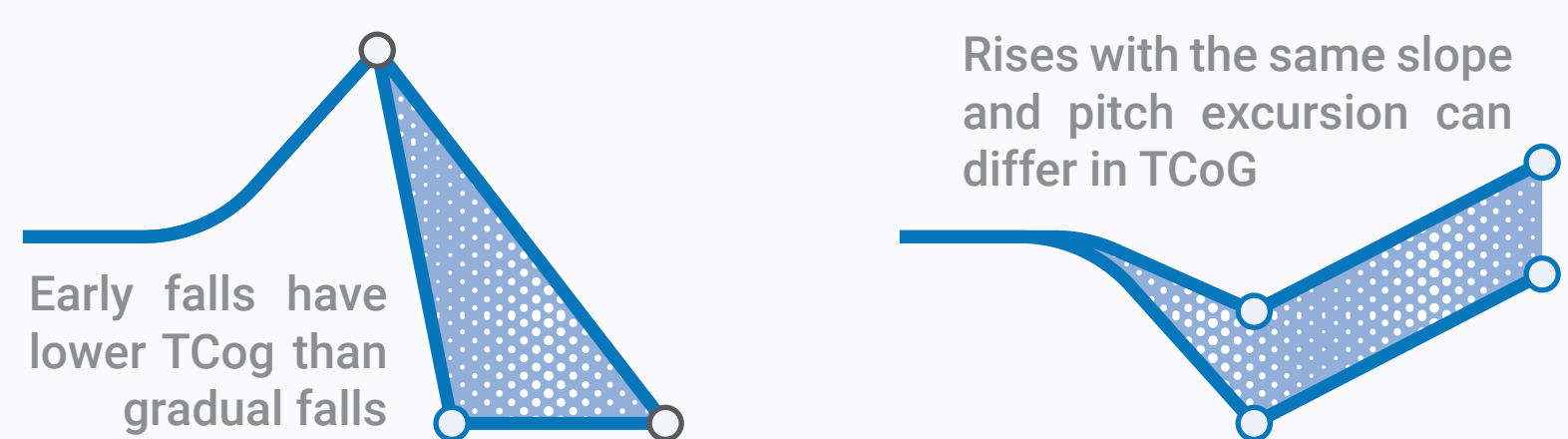
Is it only where it falls/rises **towards**?

Or rather where it falls/rises **from**?

Is there a role for the **overall trajectory**?

Early falls have lower TCog than gradual falls

Rises with the same slope and pitch excursion can differ in TCoG

Experiment

We recruited participants from Prolific (n=110, Exp1:56 and Exp2:54)

Participants judged declarative utterances on whether the speaker was **asking** them something (=question) or **telling** them something (=assertion)

Other utterances:
Gavin's on broadway
Megan's a grandma
Ryan's in greenview
Joey's from Bronville

Molly's from Branning

Asking [F]   **Telling** [J]

Stimuli cross a 5-step **accentual pitch** continuum with a 5-step **ending pitch** continuum. Participants hear 5 repetitions of each step of the continuum (total trials=125)
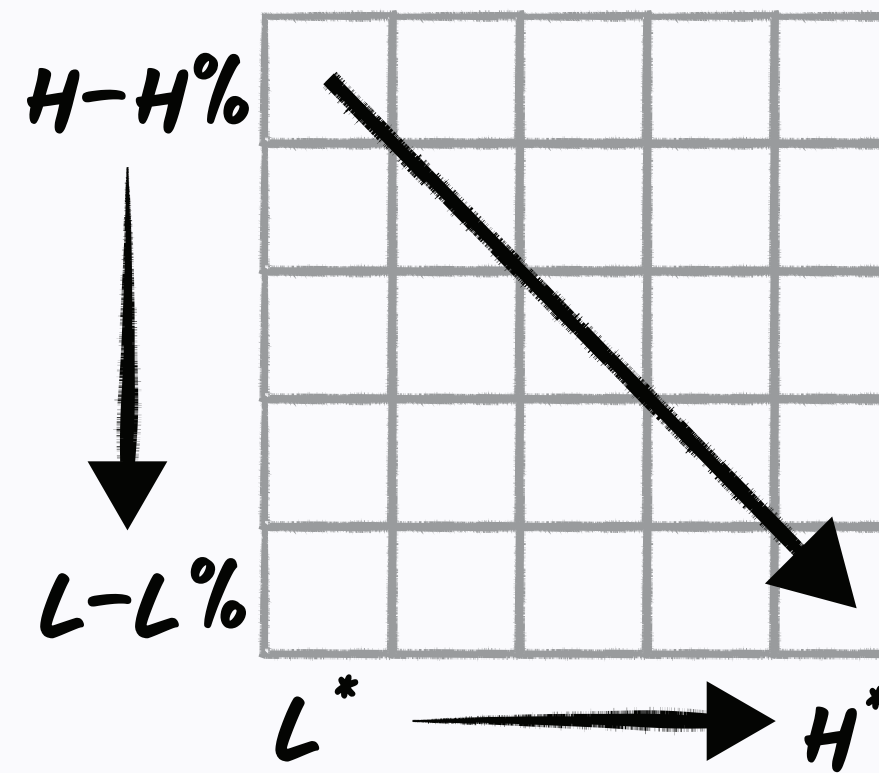
Schiefer & Batliner (1991)
Steffman et al. (2021)

To avoid comparisons between trials, participants count aloud by 2s between successive trials

Hypotheses and Predictions

How likely are assertion interpretations as we vary accentual and ending pitch?

If the edge tones matter, we predict higher % Telling when ending pitch is lower

If both matter, we predict an interaction: % Telling further increases when F0 contour is closest to H*L-L%

If the pitch accent matters, we predict higher % Telling when accentual pitch is higher

Results

Credible evidence for the predicted negative effect of ending pitch variation but slight evidence for **counterintuitive** negative effect of accentual pitch
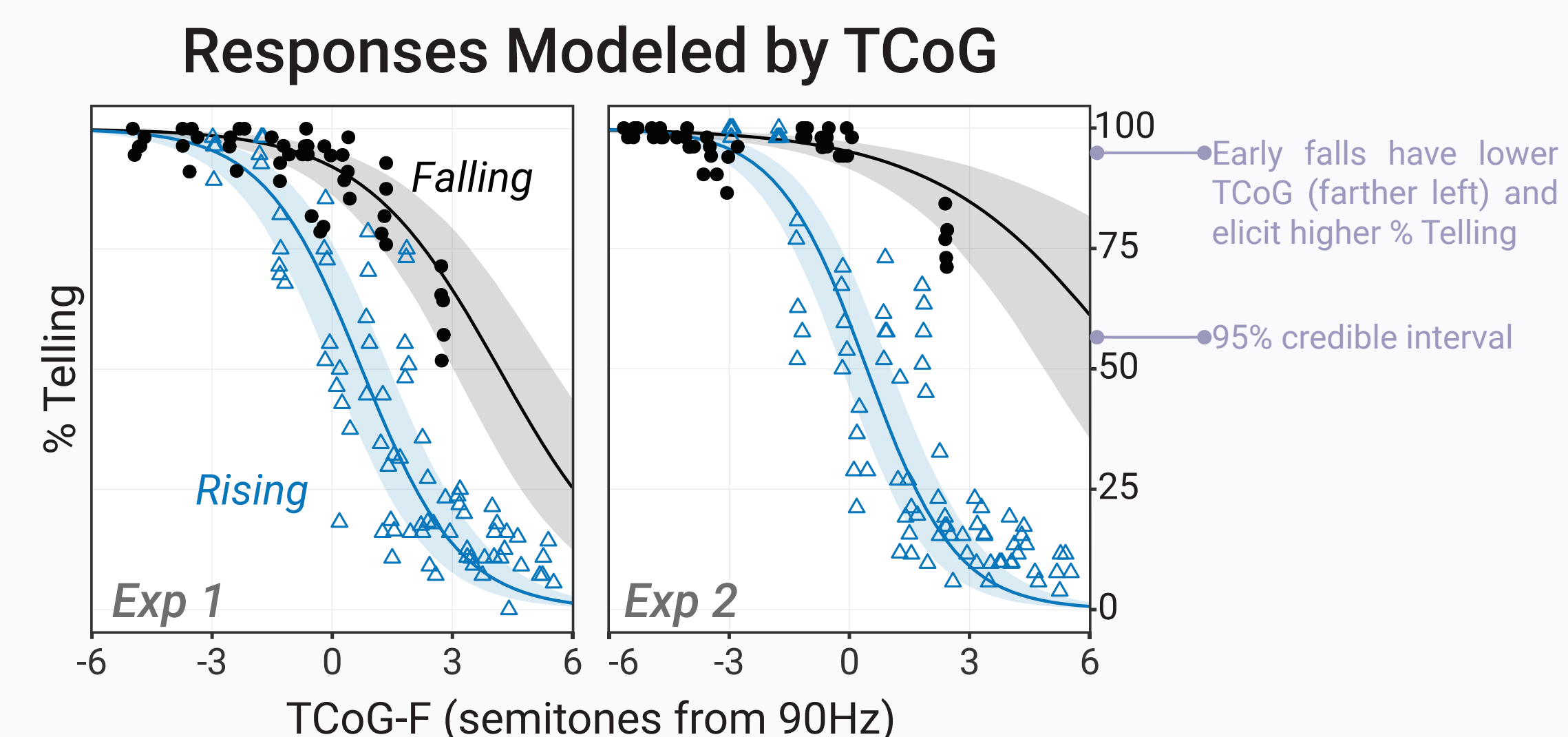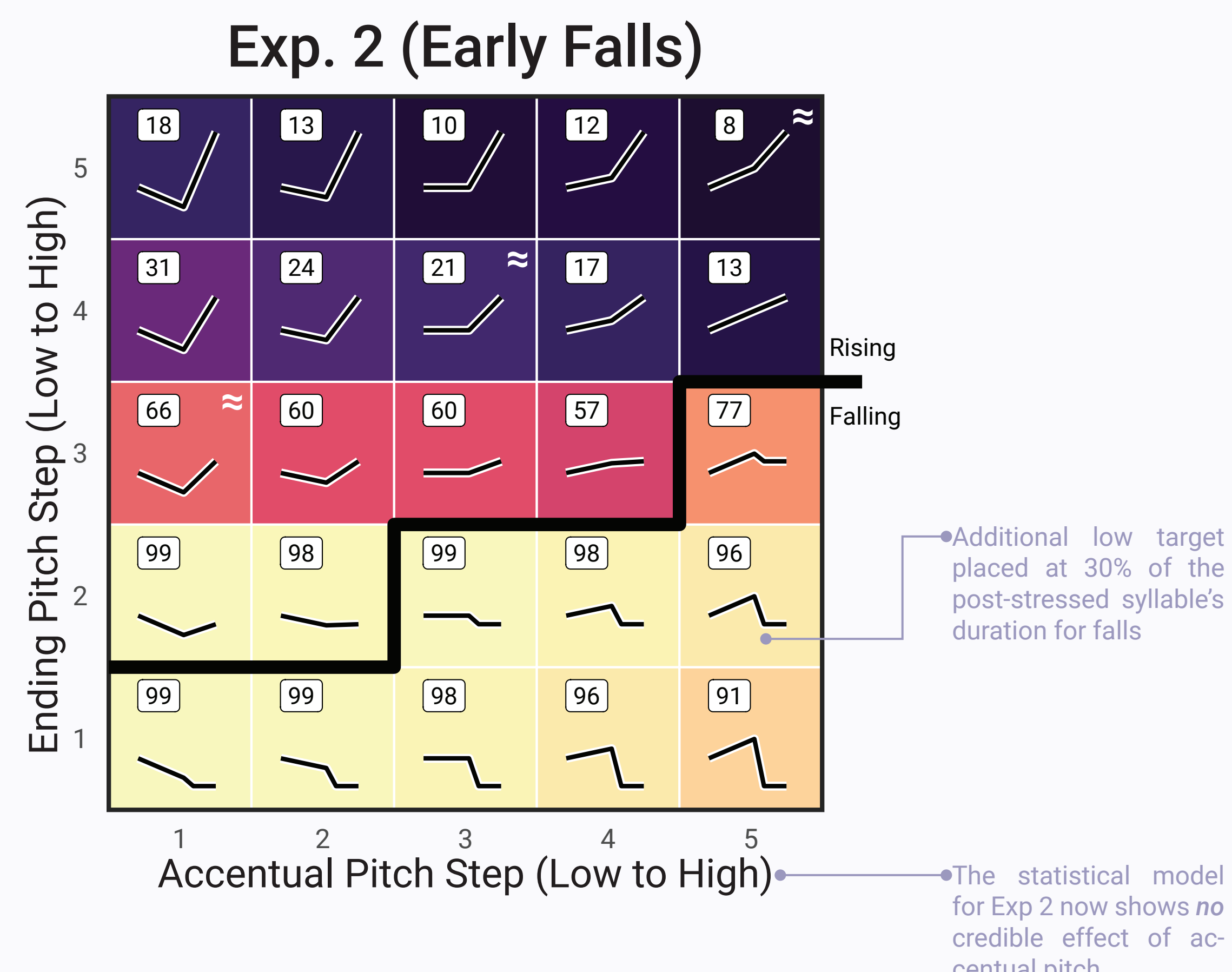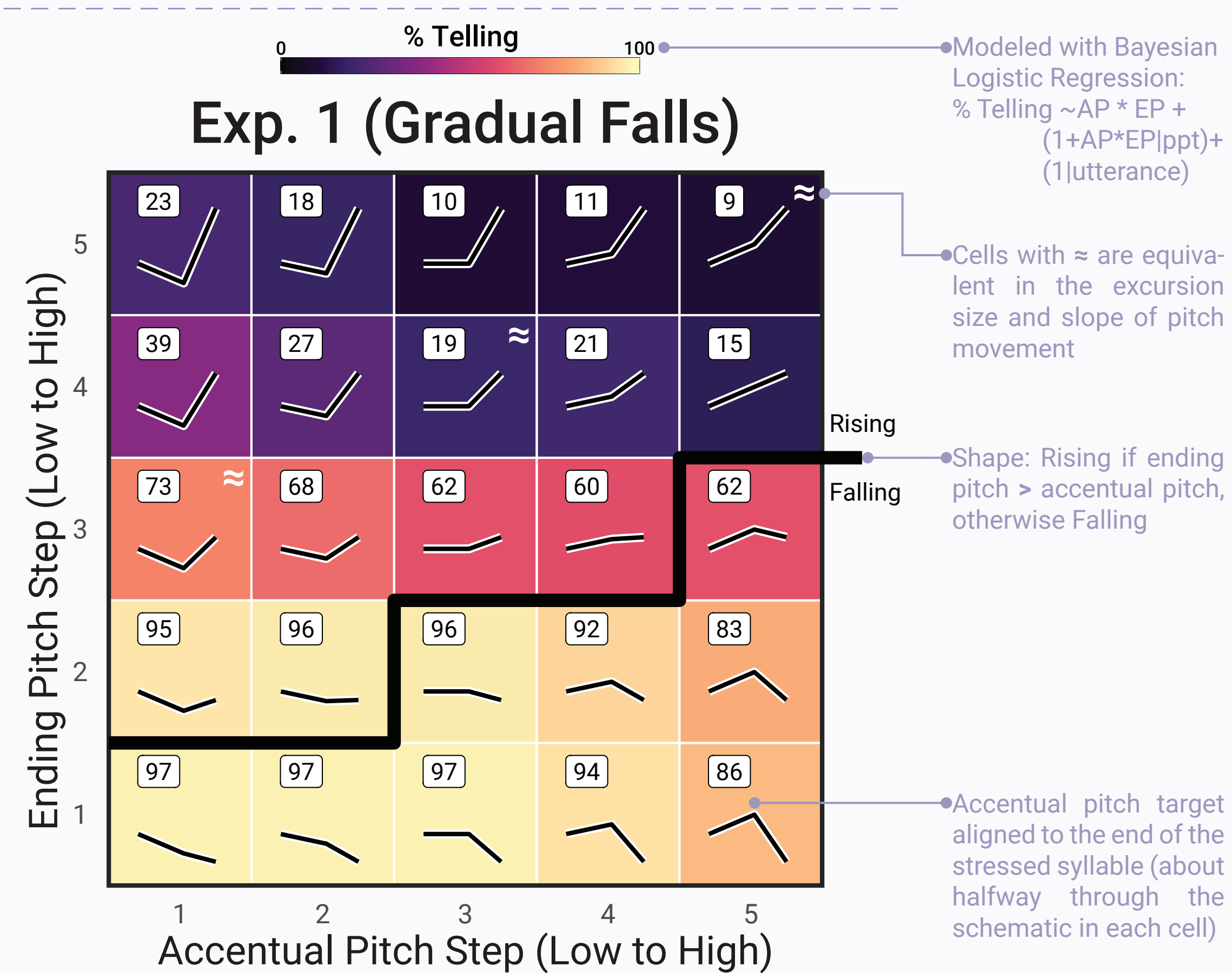
OK!   X   WHY?
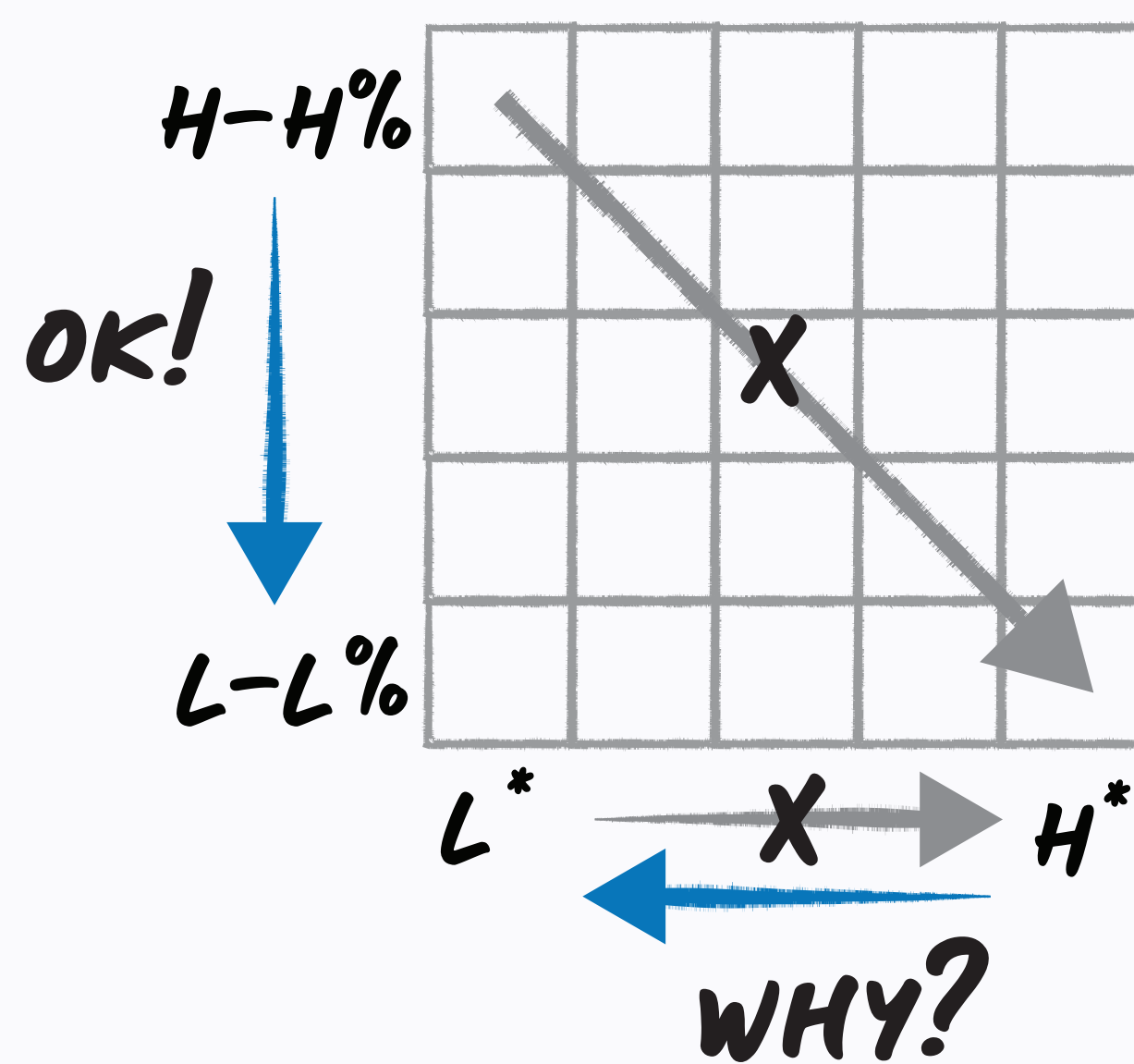
Globally higher rises *and* falls have lower % Telling: can TCoG explain why?

Higher % in this quadrant than in Exp 1?

MAGNITUDE REDUCED?
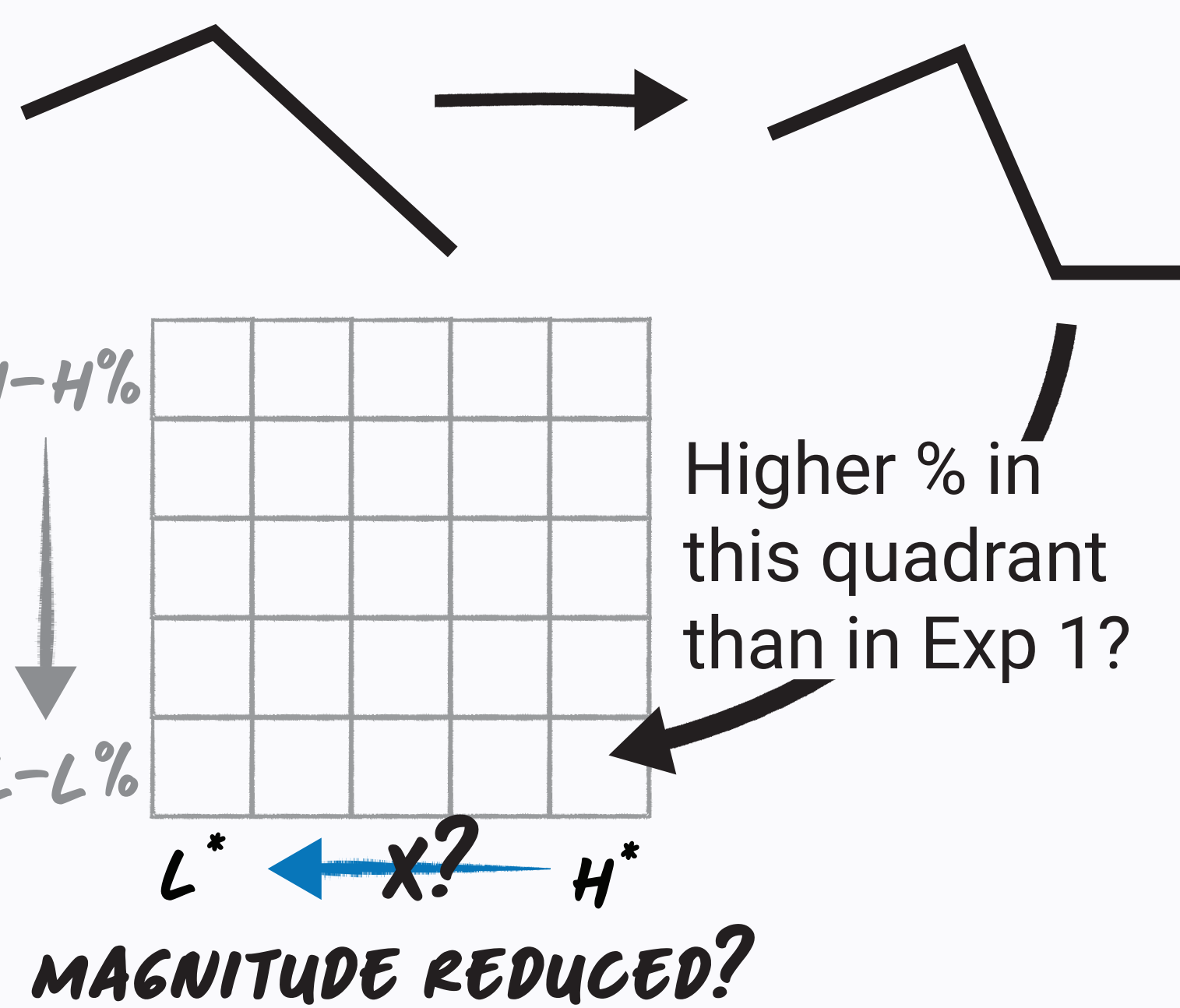
When the fall from the peak is earlier, it sounds natural *and* has lower TCoG

Modeling response variation with TCoG shows a sigmoidal response function. Model performance improves when global shape is included

The counterintuitive negative effect of accentual pitch is in fact predicted by TCoG: **higher accentual pitch raises TCoG, yielding slightly lower % Telling**

Exp. 1 (Gradual Falls)

% Telling 0 ——— 100

	1	2	3	4	5
5	23	18	10	11	9 ≈
4	39	27	19 ≈	21	15
3	73 ≈	68	62	60	62
2	95	96	96	92	83
1	97	97	97	94	86

Ending Pitch Step (Low to High) / Accentual Pitch Step (Low to High)

Rising / Falling

- Modeled with Bayesian Logistic Regression: % Telling ~AP * EP + (1+AP*EP|ppt)+ (1|utterance)
- Cells with ≈ are equivalent in the excursion size and slope of pitch movement
- Shape: Rising if ending pitch > accentual pitch, otherwise Falling
- Accentual pitch target aligned to the end of the stressed syllable (about halfway through the schematic in each cell)

Exp. 2 (Early Falls)

	1	2	3	4	5
5	18	13	10	12	8 ≈
4	31	24	21 ≈	17	13
3	66 ≈	60	60	57	77
2	99	98	99	98	96
1	99	99	98	96	91

Ending Pitch Step (Low to High) / Accentual Pitch Step (Low to High)

Rising / Falling

- Additional low target placed at 30% of the post-stressed syllable's duration for falls
- The statistical model for Exp 2 now shows *no* credible effect of accentual pitch

Responses Modeled by TCoG

Falling   *Rising*   *Exp 1*   *Exp 2*

% Telling — TCoG-F (semitones from 90Hz)

- Early falls have lower TCoG (farther left) and elicit higher % Telling
- 95% credible interval

Conclusions

Question/Assertion interpretation is driven by variation in **ending pitch**, and not accentual pitch: higher ending pitch is less likely to receive a Telling response.

Q/A contrast doesn't seem to involve the pitch accent. Prior work predicting H*H-H% as more assertive than L*H-H% not supported.

A Tonal Center of Gravity account helps explain initial counterintuitive effect of pitch accent, motivating a second experiment which eliminated the effect.

TCoG perspective suggests a more probabilistic relation to phonetic gradience.

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