What can Listeners tell us about Epistemic Meaning and the LLL Tune in American English?

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NORTHWESTERN UNIVERSITY
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What do you mean when you say it like that?

Why did you say it like that?

It's Not What You Say (But How You Say It)

Song by Happy Face Factory
What kind of meaning?

How can we elicit this data?

How can we be sure the data is valid?

What kind of data-driven analyses can we use?

Listeners can tell us a lot about intonational meaning!
<table>
<thead>
<tr>
<th>Pitch accent type</th>
<th>L-L%</th>
<th>L-H%</th>
<th>H-L%</th>
<th>H-H%</th>
</tr>
</thead>
<tbody>
<tr>
<td>H*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L*</td>
<td></td>
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<tr>
<td>L^+H</td>
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<tr>
<td>H^+L</td>
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<td>H^+L</td>
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</tbody>
</table>

Default for assertions

(Warren 2016)
“a speaker chooses a particular tune to convey a particular relationship between an utterance, currently perceived beliefs of a hearer or hearers, and anticipated contributions of subsequent utterances”

-Pierrehumbert and Hirschberg 1990 (271)
“...very little has been done in the way of making [Pierrehumbert and Hirschberg 1990’s] ideas precise, or systematically investigating the generality of the meanings proposed in the paper”

Büring 2016 (223)

“a speaker chooses a particular tune to convey a particular relationship between an utterance, currently perceived beliefs of a hearer or hearers, and anticipated contributions of subsequent utterances”

-Pierrehumbert and Hirschberg 1990 (271)

“little experimental work has been done on the specific epistemic contribution of intonation to sentence interpretation”

Prieto and Borràs-Comes 2018 (565)
A: What did you buy?

B: Oranges=HLL
A: Oh, great!

B: Oranges=LLL
A: ...is something wrong with them?
A: Is everything okay?
A: Well since you know I’m allergic to berries, it can’t be blueberries or strawberries...

A: What did you buy?

B: Oranges=HLL

Still sounds fine!

B: Oranges=LLL

Still sounds odd!
A: Well since you know I’m allergic to citrus, it can’t be lemons or grapefruit...

A: What did you buy?

B: Oranges=HLL

Did he not listen to her?

B: Oranges=LLL

Realizes his mistake
<table>
<thead>
<tr>
<th>IN</th>
<th>OUT</th>
<th>HLL</th>
<th>LLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answers question normally</td>
<td>Sounds uncooperative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unclear</td>
<td>Takes context into account</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Realizes mistake</td>
<td></td>
<td></td>
<td></td>
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</table>
Rises inform, and plateaus remind: Exploring the epistemic meanings of “list intonation” in American English

Rachel Steindel Burdin a, *, Joseph Tyler b

a Department of English, University of New Hampshire, Durham, NH, USA
b Sensely, San Francisco, CA, USA
I'm allergic to berries

Other than the emotional state of the speaker, what do you think he's trying to communicate when he responds with Choice A or Choice B?

Choice A sounds like...
Choice B sounds like...

How likely is it that the woman expected him to say "oranges"?

Unlikely

Neutral

Likely
Scale Responses

How likely was Oranges expected?

Allergic to Citrus

Allergic to Berries

Context manipulation

Significant main effect of context
($\beta = -1.84, z = -10.11, p < .0001$)
LLL is communicating self-reflection about the error the guy made in buying roses for his allergic gf/wife. HLL seems a bit more to-the-point without any apologetic backing to his answer.

LLL he sounds like he knows he made a mistake, HLL he is just telling her flatly it is roses.

LLL sounds like the man knows the other person will not like his response. HLL sounds like he knows the other person will like the choice.

HLL sounds like a psychopath who is happy that he just bought someone something they are allergic to. LLL sounds like he's realizing his mistake as he says oranges.
Probabilistic Classification
Naïve Bayes

Vector Semantics
Static Embeddings

What’s there?

What could be there?

laugh
seldom

obviously
frustration
regret
embarrassed
sad

annoying
Naïve Bayes

Class | $P(\text{Word} \mid \text{Class})$
---|---
HLL | 
IN | 
HLL | 
OUT | 
LLL | 
IN | 
LLL | 
OUT |

Likelihood Ratio

Disproportionately more important
Naïve Bayes

IN

OUT

HLL

HLL

LLL

LLL

Happy
Try
Track
Guess
Matter
Proud
Inform

Dislike
Disappoint
Could
Hesitate
Rather
Sweet
Reason

Surprise
Try
Inform
Care
Still
Dislike
Happy

Realize
Mistake
Regret
Would
Anticipate
LLL he sounds like he knows he made a mistake

HLL he is just telling her flatly it is roses
LLL he sounds like he knows he made a mistake

HLL he is just telling her flatly it is roses
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HLL he is just telling her flatly it is roses
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<th><strong>LLL-OUT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>But</td>
<td>Knowing</td>
<td>Surprised</td>
<td>Disappointed</td>
</tr>
<tr>
<td>Though</td>
<td>Honestly</td>
<td>Saying</td>
<td>Disappointing</td>
</tr>
<tr>
<td>So</td>
<td>Frankly</td>
<td>Say</td>
<td>Regret</td>
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<td>Quite</td>
<td>Obviously</td>
<td>Obviously</td>
</tr>
<tr>
<td>Rather</td>
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<td>Though</td>
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<tr>
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<td>Reminded</td>
<td>Honestly</td>
<td>Annoyed</td>
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<tr>
<td>Telling</td>
<td>Sense</td>
<td>Admit</td>
<td>Sad</td>
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### Emotions

- Embarrassed
- Feeling
- Mistake
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<th>Elicitation</th>
<th>Validation</th>
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<td>Scalar responses showed sensitivity to the context manipulation</td>
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Scalar responses showed sensitivity to the context manipulation

Important terms for LLL are negatively valenced, epistemic in OUT context

Semantic neighborhood reflects linguistic function, hints at other contexts

Interaction Between Tune and Context

Common meanings across LLL tune and OUT context
LLL-OUT specifically sees more epistemic terms
Acknowledgments

Rob Voigt
Kate Sandberg (stimuli recording, second coder)
Members of ProSD Lab at Northwestern
Funding: NICO Data Science Initiative
IRB: STU00213825
### Meaning
- Empirical investigation of intonation’s epistemic contribution

### Elicitation
- Free-text responses and scalar responses in operationalized contexts

### Validation
- Scalar responses showed sensitivity to the context manipulation

### Naïve Bayes
- Important terms for LLL are negatively valenced, epistemic in OUT context

### Embeddings
- Semantic neighborhood reflects linguistic function, hints at other contexts

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- Common meanings across LLL tune and OUT context
  - LLL-OUT specifically sees more epistemic terms