

# Communicating, interpreting, and learning from uncertainty: Could be a promising approach?

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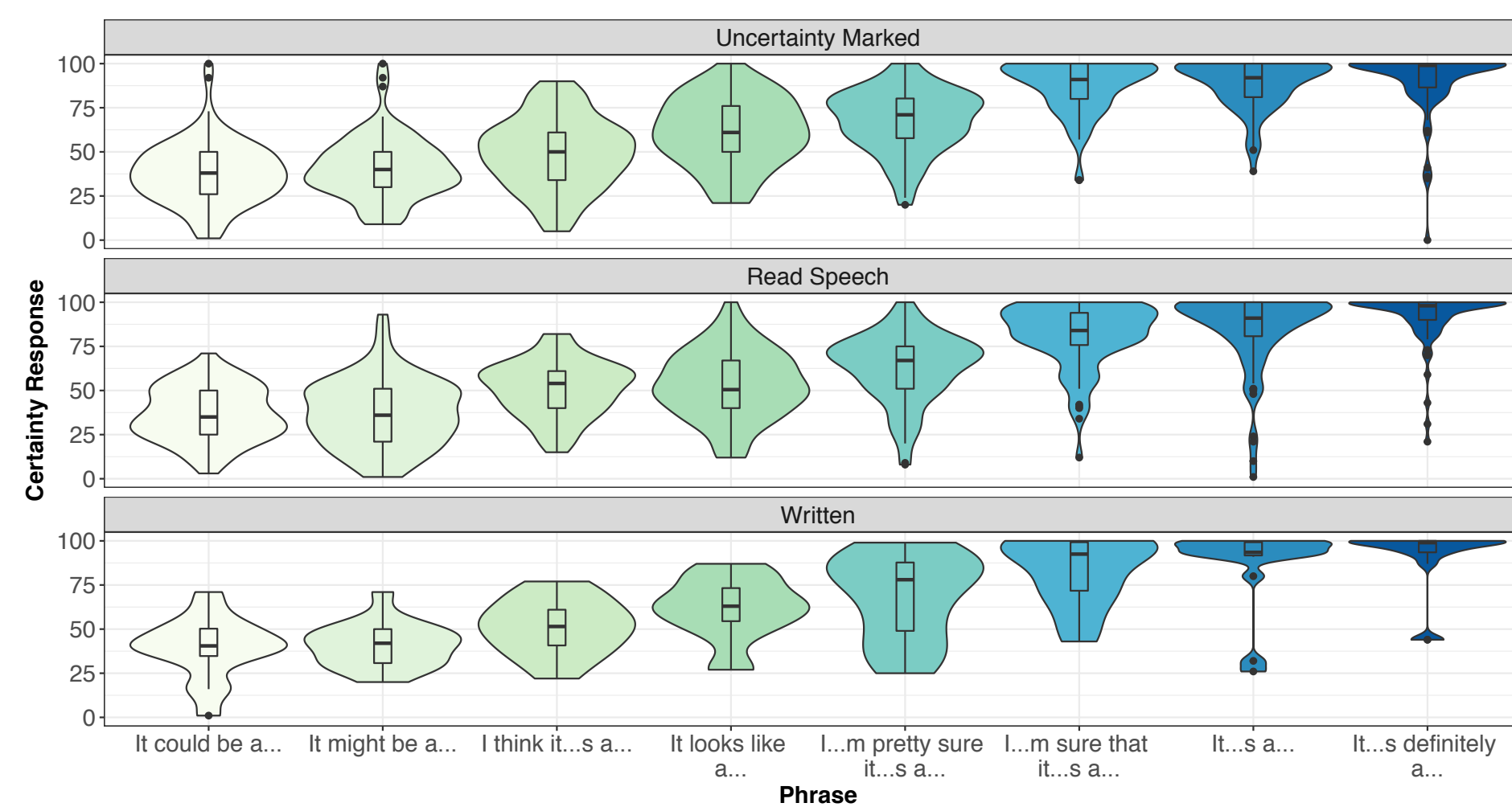
## Background & Main Questions

- Source reliability and commitment are important to pragmatics (Gunlogson, 2008; Bibyk, 2016; Brown-Schmidt, Yoon & Ryskin, 2015)
- Communicating reliability requires a speaker to appropriately mark her confidence, and for a listener to accurately interpret that reliability
- Complicated by individual and group differences in the use of confidence and its implications (e.g., politeness markings, mansplaining, etc) and costs/benefits of appearing too confident or not confident enough

- Do speakers systematically mark their uncertainty, and do listeners systematically recover this information?
- Can we test whether a speaker's objective certainty maps onto their linguistic certainty?
- How do listeners incorporate certainty marking when acquiring new information, or throughout continued experience with a speaker?

## Pre-test: Marking / Interpreting Uncertainty

- It could be a goose
- It might be a robin
- I think it's a falcon
- It looks like a hummingbird
- I'm pretty sure it's a woodpecker
- I'm sure that it's a sparrow
- It's a blackbird
- It's definitely a canary

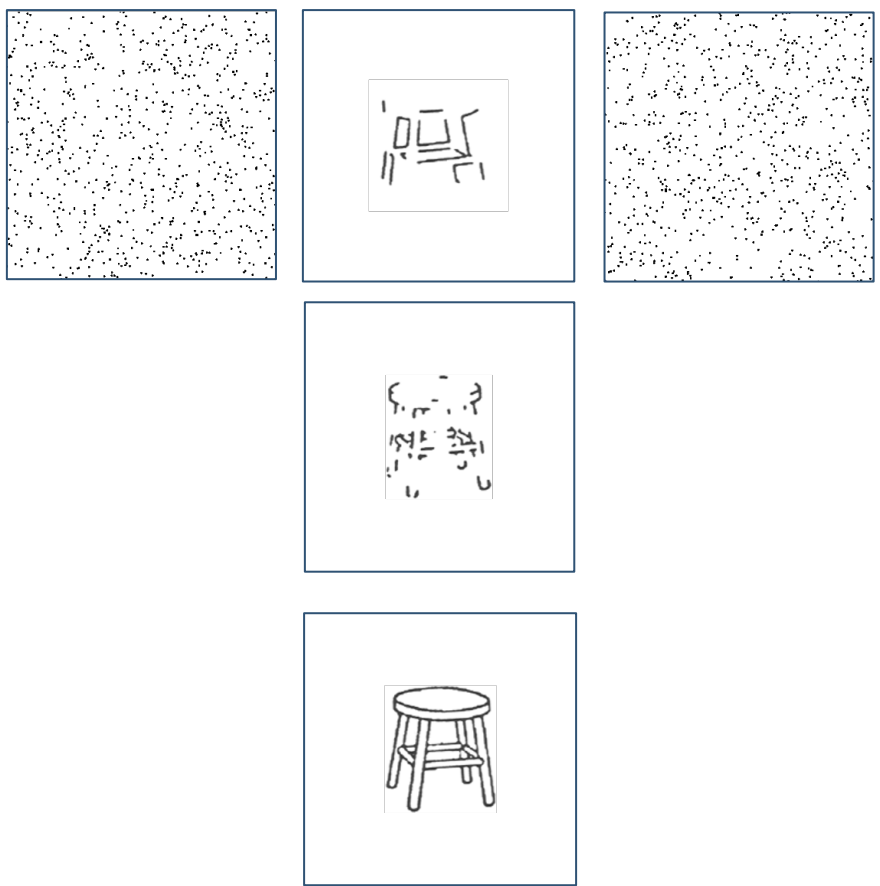


**General Findings:** listeners systematically interpret these phrases as differing in certainty

Phrase	Pre-test Read-text Confidence	Pre-test Listen (Read)	Pre-test Listen (Uncertainty)	Read-text Rank	Listen Rank	Experiment 1 (mean confidence)	Experiment 2 (mean confidence)
1	36.994	37.706	36.283	7.125	7.063	25.163	24.68
2	39.294	41.094	37.494	6.375	6.375	28.798	
3	49.918	48.918	50.919	5.688	5.644	46.458	25.46
4	57.080	61.362	52.797	5.25	5.381	45.828	
5	65.476	68.110	62.842	4.063	4.319	68.577	
6	84.220	87.510	80.930	2.688	2.919	80.300	
7	86.777	88.864	84.689	2.625	2.525	91.765	80.40
8	90.935	90.246	91.624	2.188	1.775	93.192	
Control							64.55

## E1: Mapping Visual Uncertainty onto Visual Uncertainty

(Stimuli adapted from Biederman, 1987)



**Time:** 120/220/750 ms

**Recoverability:**

Non-recoverable, Recoverable, Complete

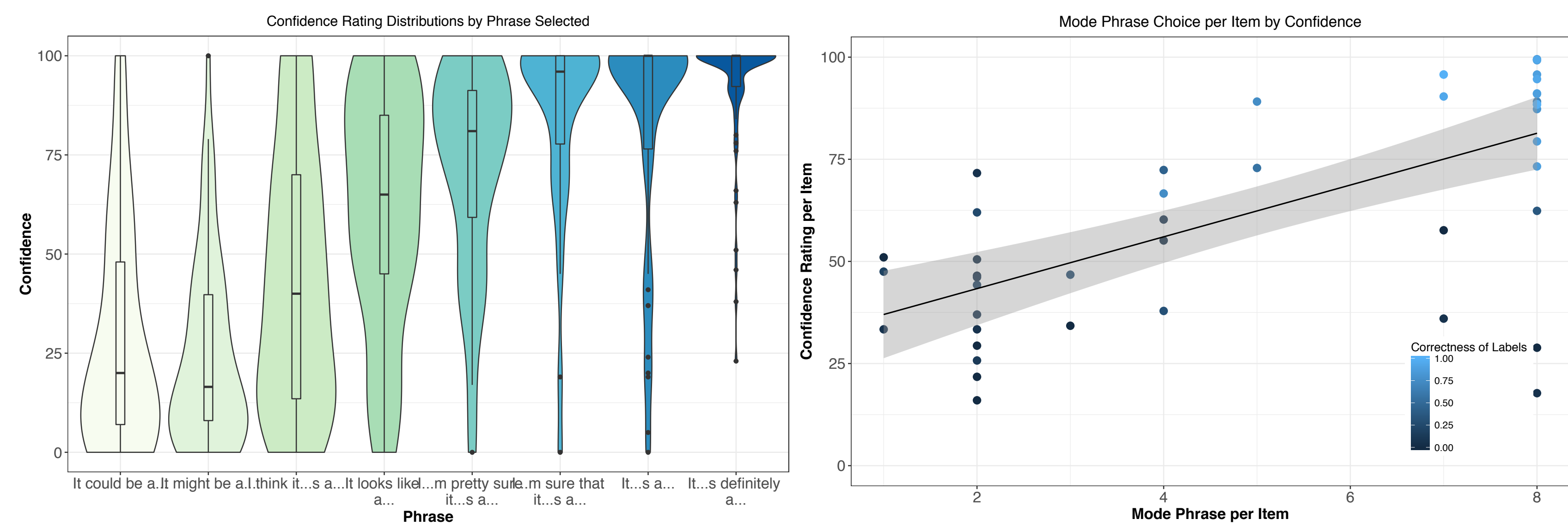
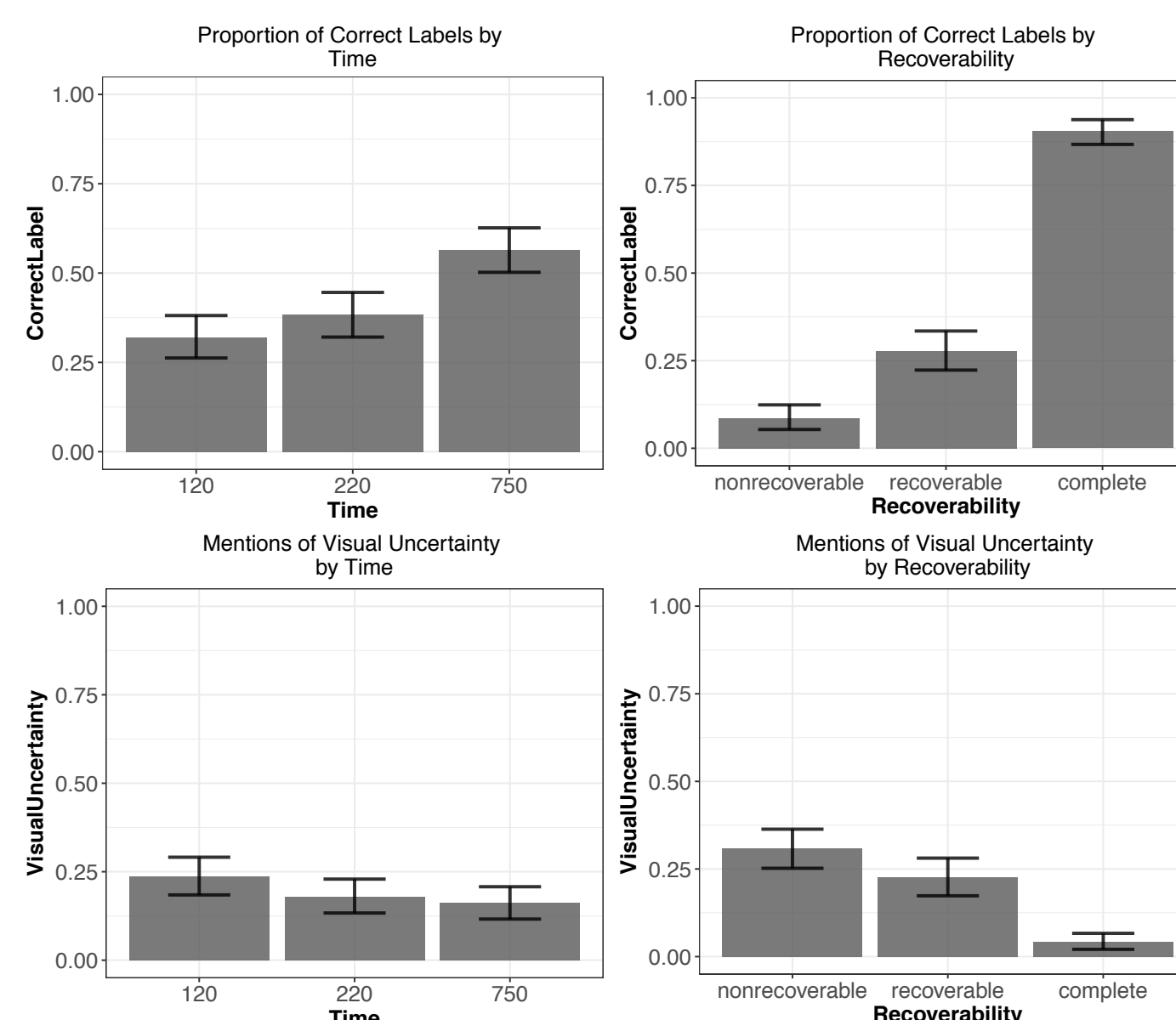
**3 measures:**

What did you see?

How confident are you that you correctly labeled the image?

Which is the most likely phrase that you would use to describe what you saw to another person?

**Manipulation Check:**



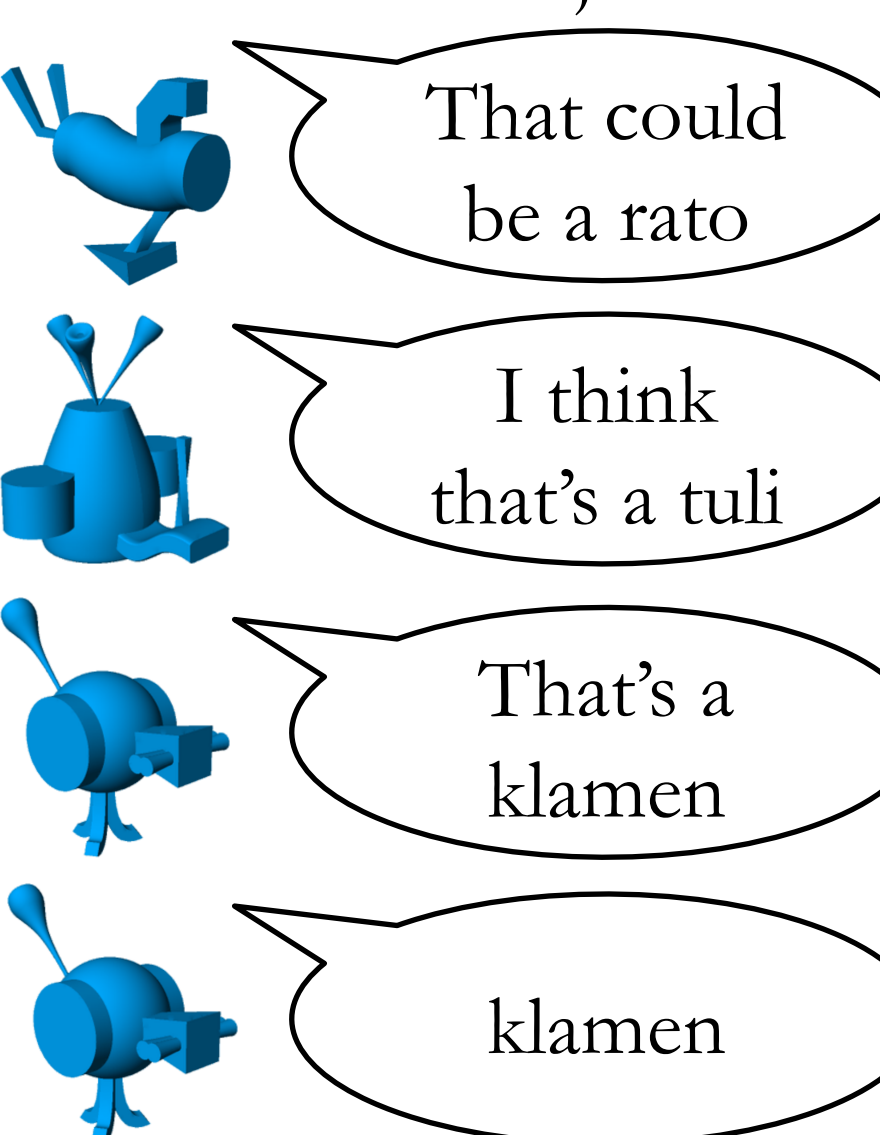
**General Findings:**

- We can measure know empirically how certain a speaker should be
- Can then investigate how speaker certainty maps onto their linguistic choices
- Can ask how this influences listener behavior

## E2: Behavioral Effects of Certainty on Learning

**Learning:**

12 novel objects



**Test:**

6 matching labels  
6 mismatched labels

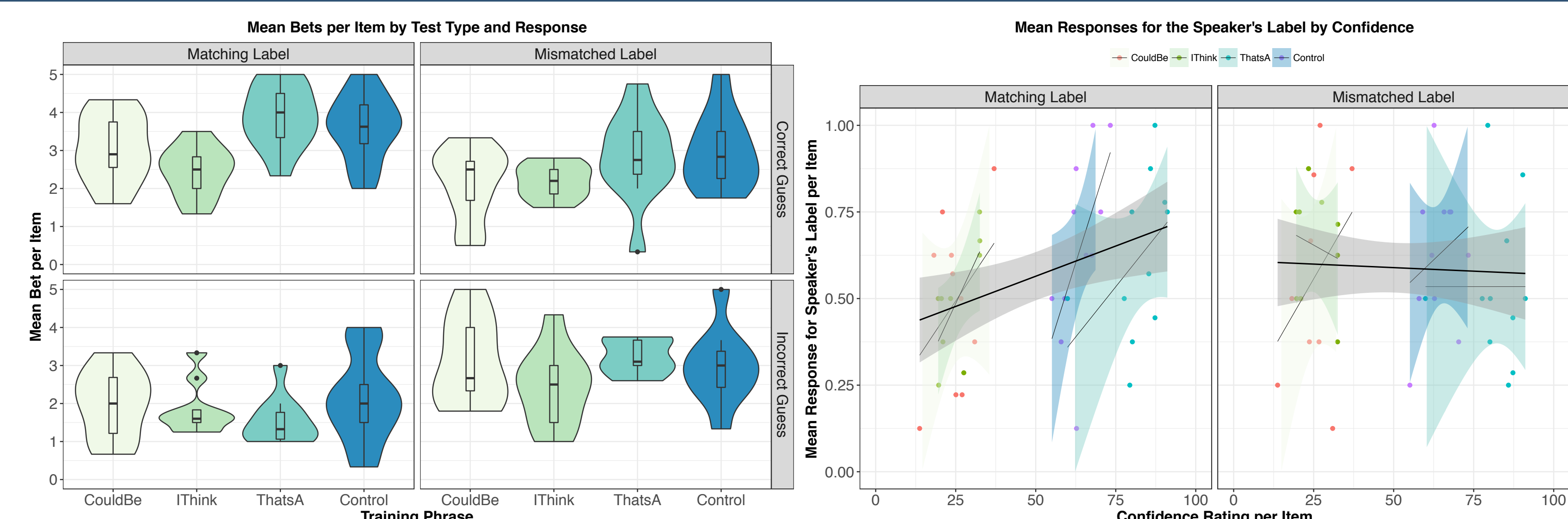
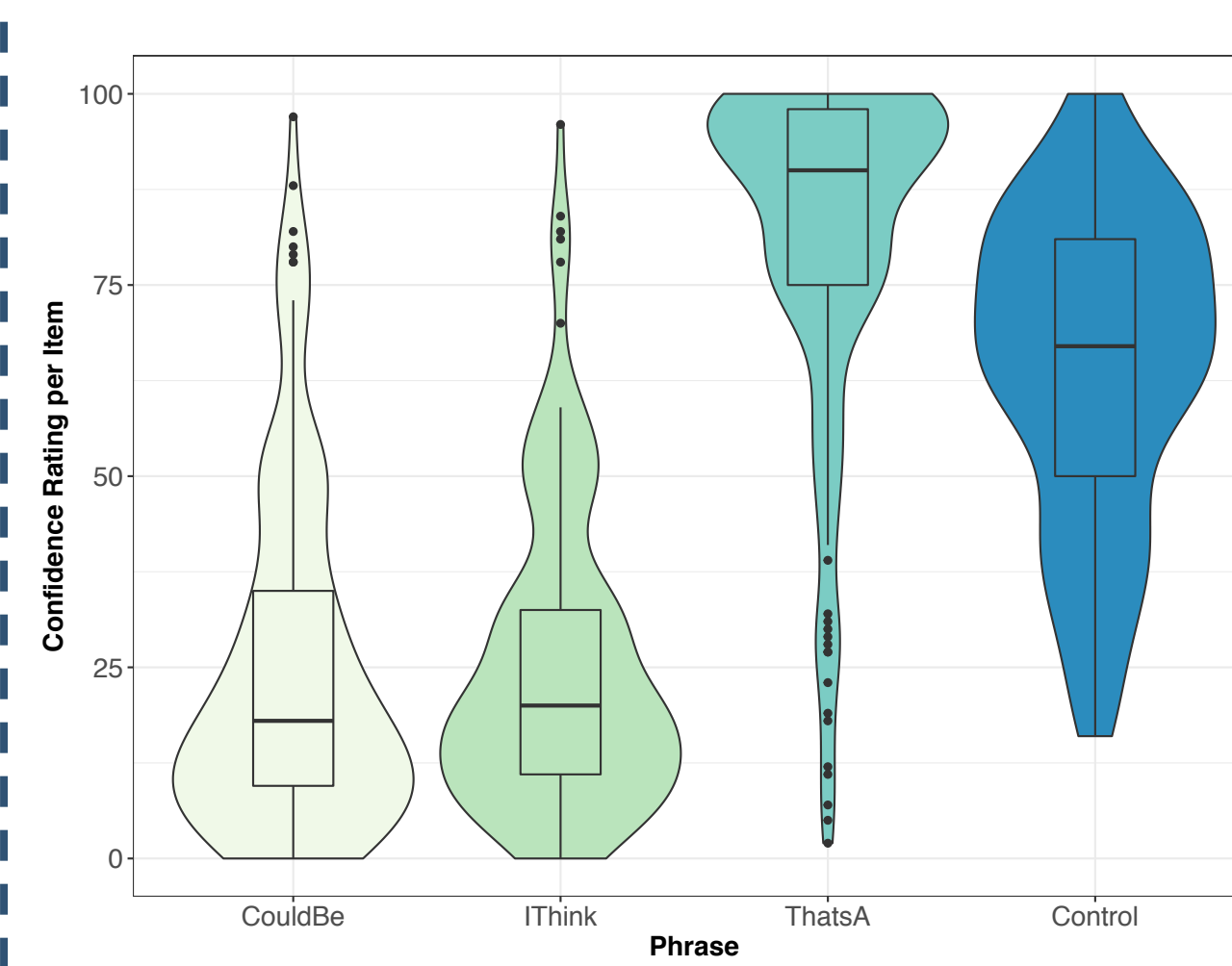
tuli (match)  
klamen (mismatch)

**Bet:**

Up to \$0.05 that you're correct

**Norming:**

How certain does the speaker sound about their label?



**General Findings:**

- Can investigate how speaker certainty maps onto a listener's judgment about the speaker's knowledge (about a label), and consequently their beliefs about the veracity of the information / their commitment to that information

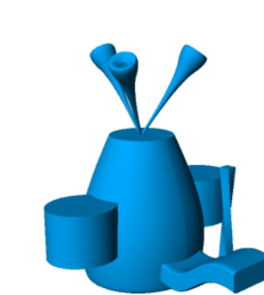
## Summary: a promising approach

- Speakers and listener's systematically produce and interpret utterances marked with uncertainty.
- We have successfully designed tasks manipulating speaker certainty, and then evaluating how certainty maps onto linguistic choices
  - Future work will quantify objective certainty by grounding objective certainty with visual stimuli
- A speaker's certainty influences a listener's learning behaviors, suggesting listeners make inferences about the information being conveyed in a nuanced way
  - Ongoing and future work explores scenarios where sources express different levels of confidence, for converging and conflicting judgments by speakers who might differ in reliability, knowledge, gender, etc.

## Current and Future Directions

**Learning from 2 speakers:**

12 novel objects



That's definitely a tuli

That could be a mafer

**Learning from an un/certain speaker:**

Domain expertise



A kale stripper

The leaf shaped tool with holes in it

**Adapting to un/reliable speakers:**

Over/under confidence



That's definitely a klamen

I know that is called a "tuli"