Veridicality and utterance meaning

Marie-Catherine de Marneffe,
Christopher D. Manning and Christopher Potts

NLP Group

Stanford University

What information status do people attribute to what they read?

FBI agents alleged in court documents today that Zazi had admitted **receiving** weapons and explosives training from al Qaeda operatives in Pakistan last year.

received(Zazi, weapons_and_explosives_training)

➡ Does this event correspond to an actual situation in the real world?

Starting point: FactBank 1.0

Original:

Some experts now predict Anheuser's entry into the fray **means** near-term earnings trouble for all the industry players.

Normalized event:

Anheuser's entry means near-term earnings trouble

Veridicality assignment:

f(means, author) = Uu

f(means, experts) = PR+

Veridicality scale from FactBank

[Saurí & Pustejovsky 09]

Tag	Meaning	Counts
CT+	certainly the case that X	7,749
CT-	certainly not the case that X	433
PR+	probably the case that X	363
PR-	probably not the case that X	56
PS+	possibly the case that X	226
PS-	possibly not the case that X	14
Uu	does not know or does not commit	4,607

Space of veridicality

- **Markers of possibility**

  can, could, may, might, presumably, seemingly

- **Markers of probability**

  apparent, likely, probable

- **Markers of uncertainty**

  attitude predicates: say, announce, report

- **Markers of certainty**

  factive verbs: know, realize, regret, learn

What are people's veridicality judgments?

- 642 sentences from Saurí's training set

(1) Rally officials weren't available to **comment** yesterday.

Based on your reading, do you think that

Rally officials commented yesterday.

○ certainly	happened/is happening/will happen
○ probably	
○ possibly	

○ certainly not	happened/happening/will happen
○ probably not	
○ possibly not	

○ unknown (no claims about the event)

- Overall Fleiss kappa 0.53

What we found

- Veridicality judgments are shaped by both linguistic and contextual factors

- They are systematic enough to be modeled

- Yet there is some variability in readers' interpretations

  ➡ Need to focus on the "meaning in the world"

MTurk vs. FactBank

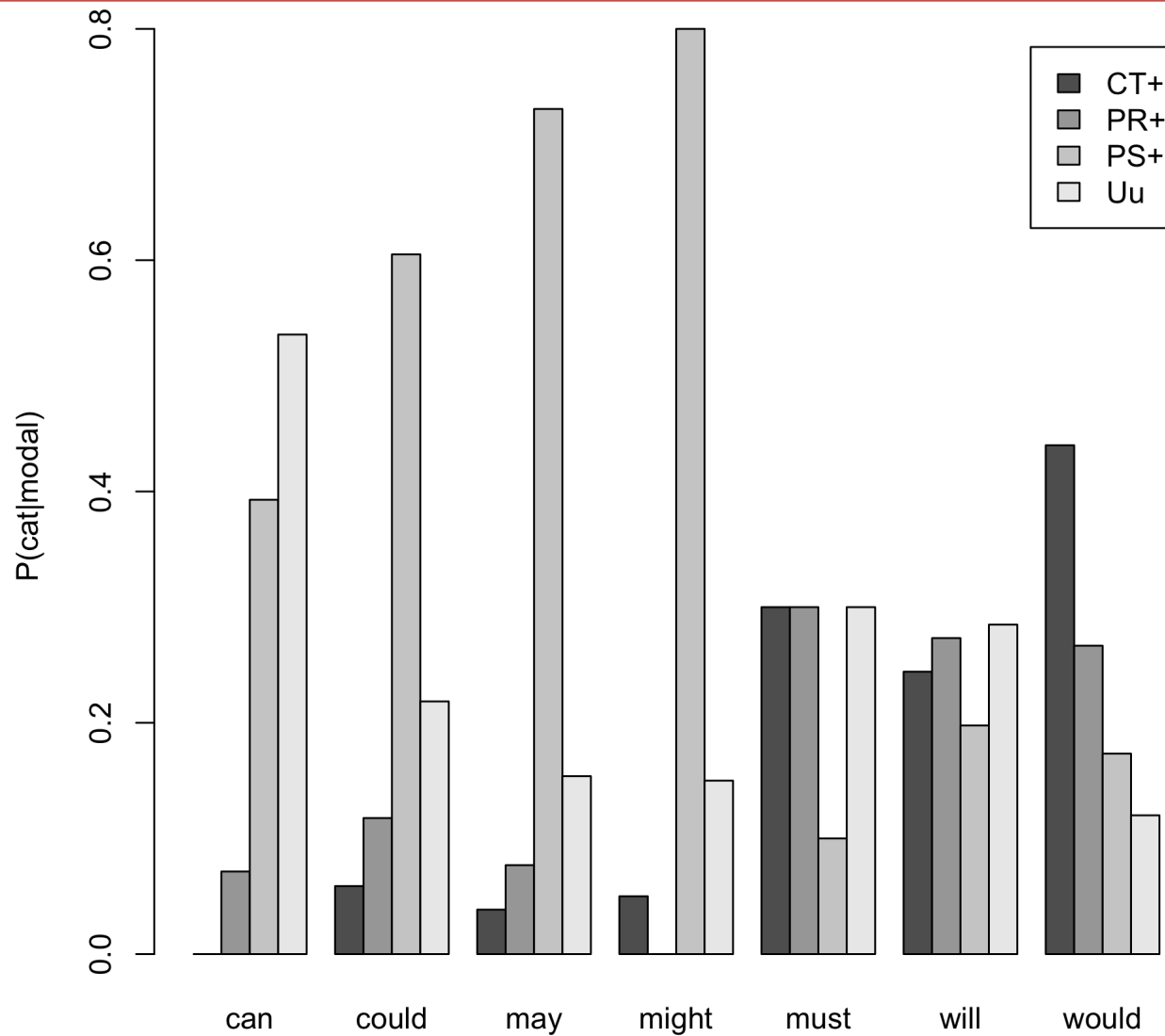|	κ	p-value
CT+	.37	< 0.001
CT-	.91	< 0.001
PR+	.79	< 0.001
PR-	.77	< 0.001
PS+	.86	< 0.001
PS-	-0.001	0.982
Uu	.06	0.203

Attitude predicates

- Magna International Inc.'s chief financial officer, James McAlpine, **resigned**, the company said. — CT+ 10

- In the air, U.S. Air Force fliers say they have **engaged** in "a little cat and mouse" with Iraqi warplanes. — CT+ 9 / PS+ 1

- Merieux officials said last week that they are "highly confident" the offer will be **approved**. — PR+ 10

More nuanced veridicality values for modals

"could" carries different veridicality values

- They aren't being allowed to leave and could **become** hostages.

  PS+ 10

- Over the weekend, Pentagon officials confirmed reports that a fourth U.S. aircraft carrier and its powerful group of support ships could **head** for the Middle East within a few days.

  PR+ 5
  PS+ 4
  Uu 1

- Iraq could start **hostilities** with Israel either through a direct attack or by attacking Jordan.

  Uu 6
  PS+ 3
  PR+ 1

Inherent variability

- In a statement, the White House said it would do "whatever is necessary" to ensure **compliance** with the sanctions.

Uu 5
PR+ 5

- Last Friday's announcement was the first official word that the company's plans for a surge in market share may have been overly **optimistic**.

PS+ 5
PR+ 5

Variability in readers' interpretations

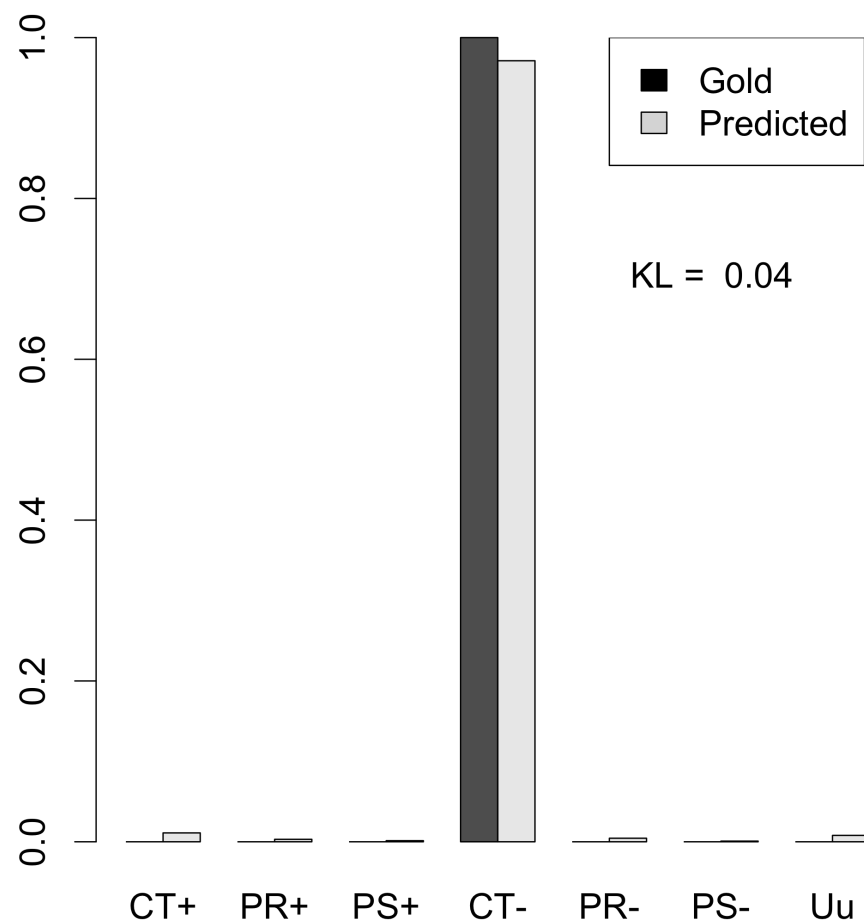literal meaning

meaning in the world

"The Faithful Translator will give the letter where possible, but in any case the spirit".

J. B. Postgate

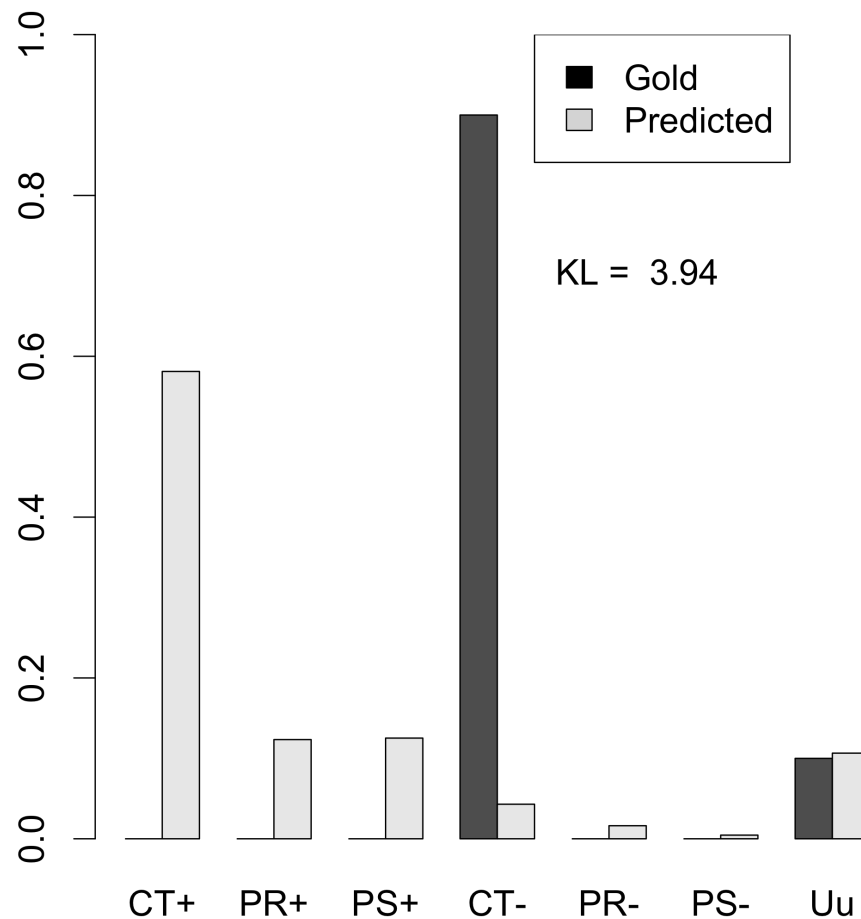# Modeling veridicality judgments as distributions

- Amherst police officials declined to **comment** Saturday.

Legend:
- Gold
- Predicted

KL = 0.04

X-axis: CT+ PR+ PS+ CT- PR- PS- Uu

Our classifier can be off

- But never before has NATO **reached** out to its former Eastern-bloc enemies.
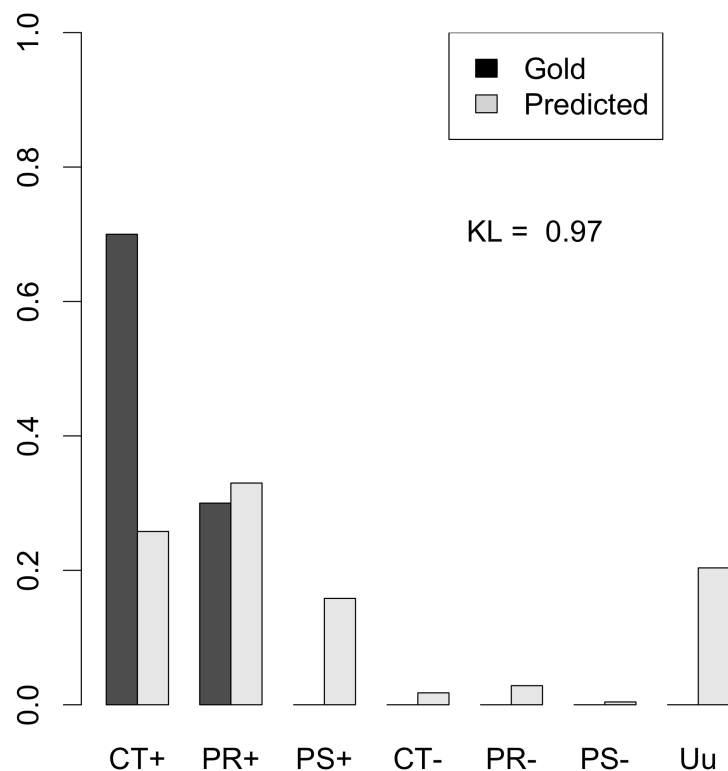
Results

	Train	Test
mean KL-divergence	0.95	0.81

Few errors of polarity,
most errors are in degree of confidence

- The NATO summit, she said, would produce an **initiative** that "responds to the grave threat posed by weapons of mass destruction and their means of delivery".

Insights about the interpretation of lexical markers

believed	more likely to indicate probability
could *may*	more likely to indicate possibility
say	Uu according to lexicalist theories but correlates highly with CT+
want	marker PS+ (instead of Uu)
know	marker of PS+ (instead of CT+)

Conclusion: Meaning in context

- Natural Language Understanding means modeling how people deal with linguistic input.

  What people take away is pragmatic meaning.

- We need to find ways to model richer contextual features.