Compound contributions and entropy

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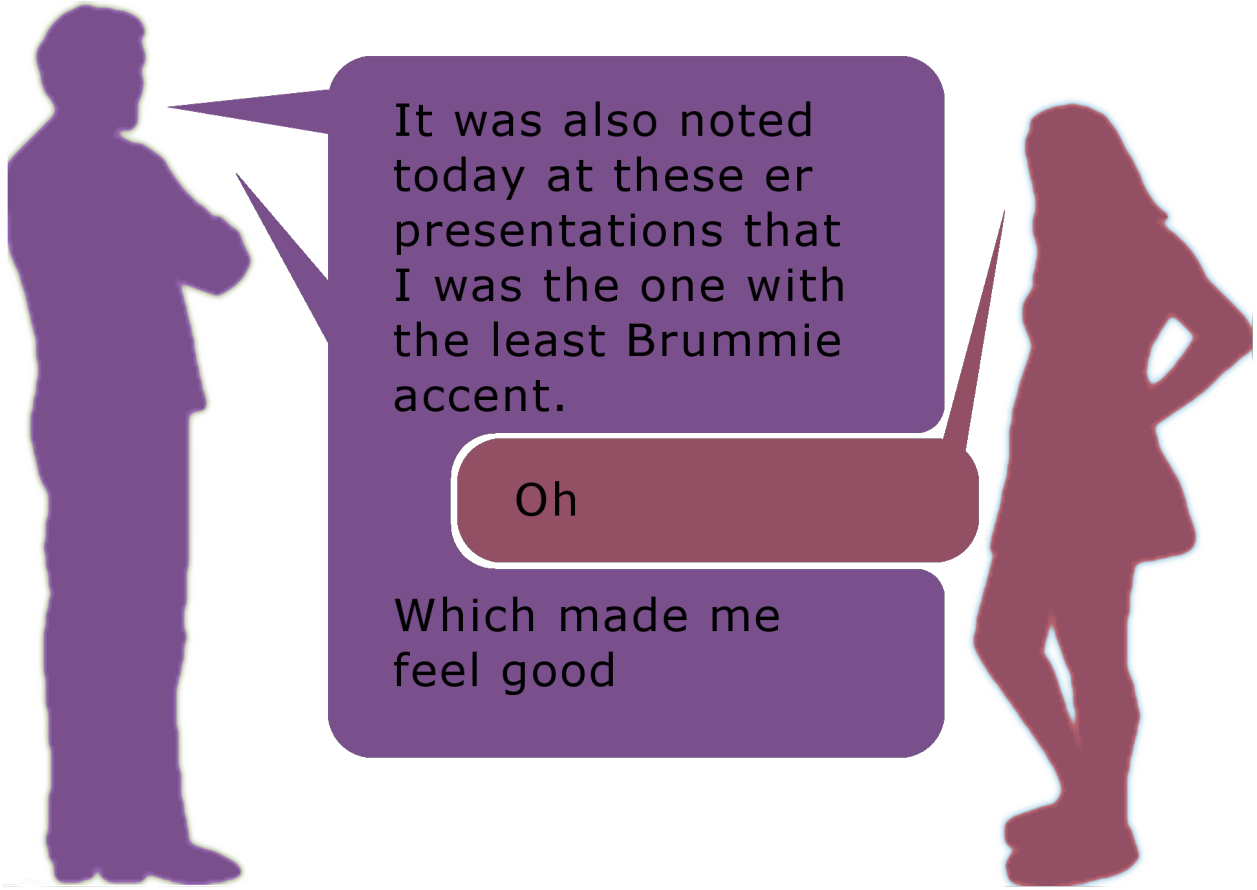
Expansions

- Compound contributions are common in dialogue
- Some add material to something already "complete":



Completions

- Compound contributions are common in dialogue
- Some continue something apparently "incomplete":

Why are they interesting?

- They're quite common
  - 3-5% of turns (Purver et al 2009)
- They perform various important functions:
  - asking for clarification
  - demonstrating inter-person coordination
  - (Howes et al, 2011)
- They don't mean the same as two independent turns!

- So dialogue systems need to understand them
  - (or at least be aware of them!)

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"Transition relevance points" (e.g. Schegloff, Lerner . . .)

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Predictability of meaning, structure, words?

We can't tell what's coming next?

Unpredictability of meaning, structure, words?

Predictability

- How can we measure "predictability" of various kinds?

Information-theoretic measure

Entropy of a linguistic item given its prior context:

words $w_1 \ldots w_n$:	emma	wants	to	go	to	the	shops
PoS $s_1 \ldots s_n$:	NP0	VBZ	COMP	VBP	PRP	DET	NNP

$$p^i_w = p(w|w_i, w_{i-1}, \ldots) \qquad H^i_{lex} = -\sum_w p^i_w log(p^i_w)$$

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- Lexical vs syntactic; what about semantics? pragmatics?

Predictability

- How can we measure "predictability" of various kinds?

Surprisal = self-information $I(w)$

$$I(w) = -log(p(w|w_i, w_{i-1}, \ldots))$$

Correlation with online reading times in incremental parsing (e.g. Hale, Roark . . .)

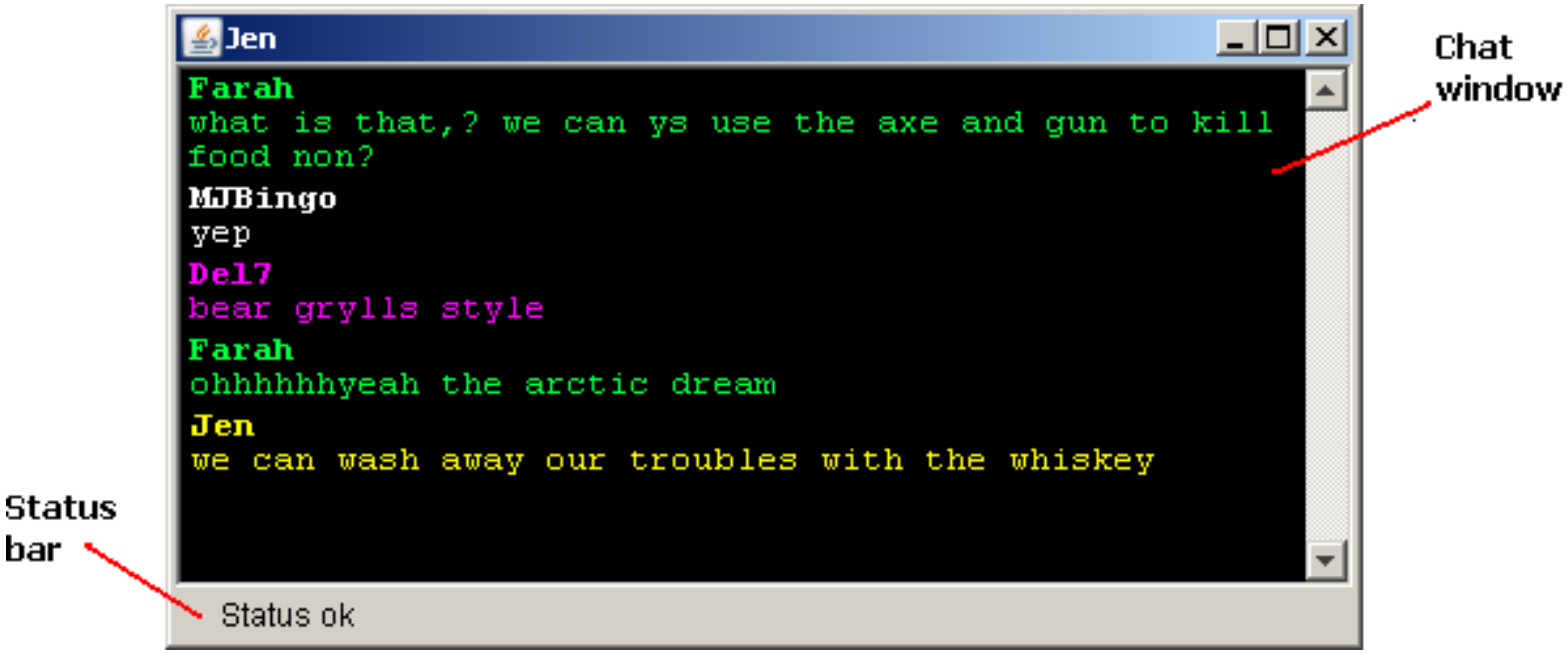
Perplexity = average entropy (per word) of a linguistic dataset

$$p^i_w = p(w|w_i, w_{i-1}, \ldots) \qquad H^i_{lex} = -\sum_w p^i_w log(p^i_w)$$

Quality of language models

The interface

- Text-based interface
  - Interventions can be introduced into a dialogue in real time
- Character-by-character interface



The intervention

Single contributions artificially split into two parts

- Truncation point manipulated according to:
  - POS entropy
  - Lexical entropy
- First part transmitted as typed
  - Followed by "..." or "...?"
- Pause during which other person could respond
  - Any response trapped by server and not transmitted
- Second part of turn transmitted as typed
- Observe response:
  - any response? continuation (CC)? clarification (CR)?

Hypotheses

- We can make some naive predictions:

Hypothesis 1: End of turn predictability

Cross-person continuations are more likely at transition relevance places

Hypothesis 2: Structural predictability

Cross-person continuations are more likely when they are syntactically and/or lexically predictable.

Hypothesis 3: Contextual predictability

Cross-person continuations are more likely when they address topics that are part of the common ground.

Response or not

- Of the 241 interventions, 171 elicited a response (71%)
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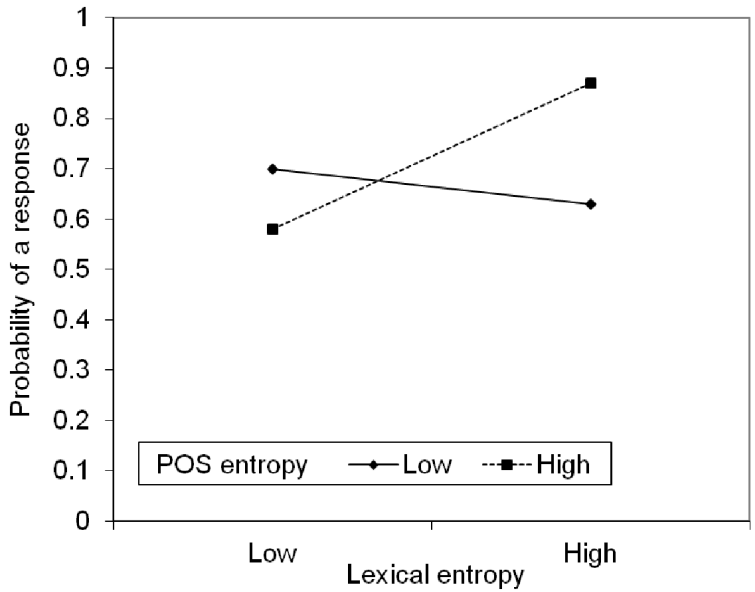

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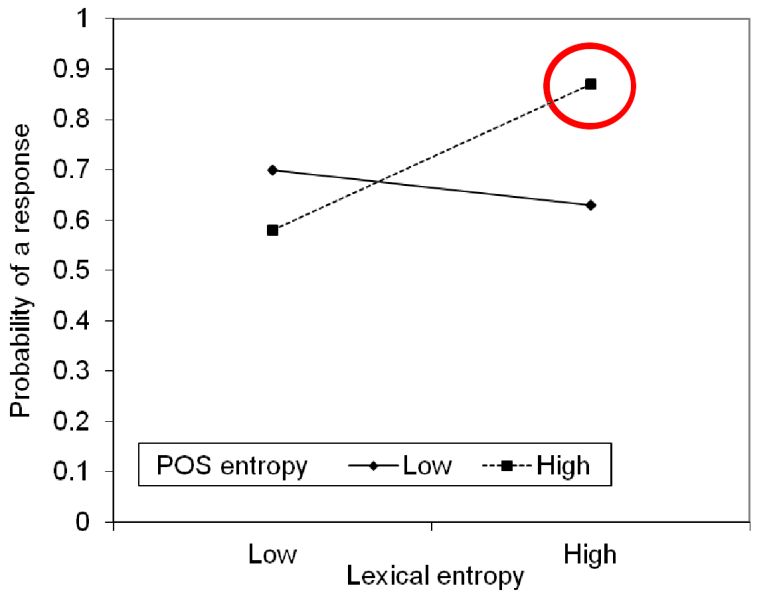
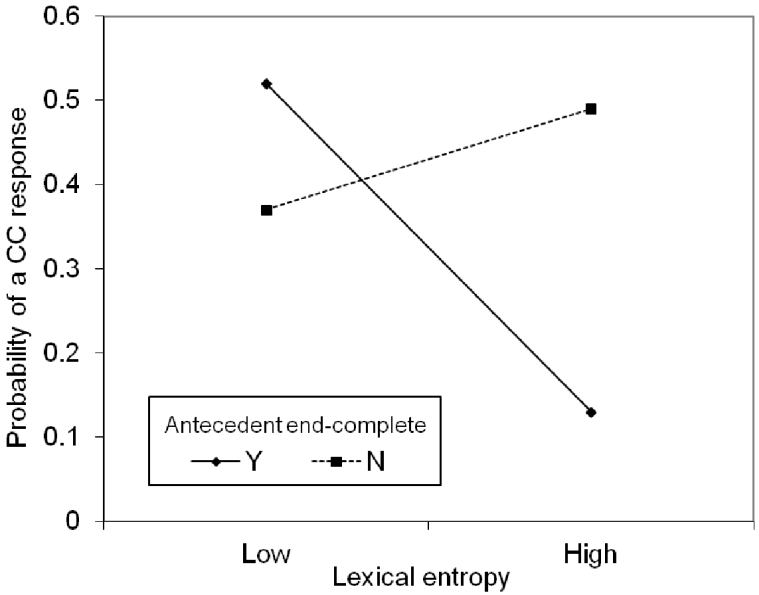


Responses more likely where both next word and next syntactic element are unpredictable

Compound contributions

- No simple main effects
- Interaction between antecedent end-completeness $\times$ lexical entropy



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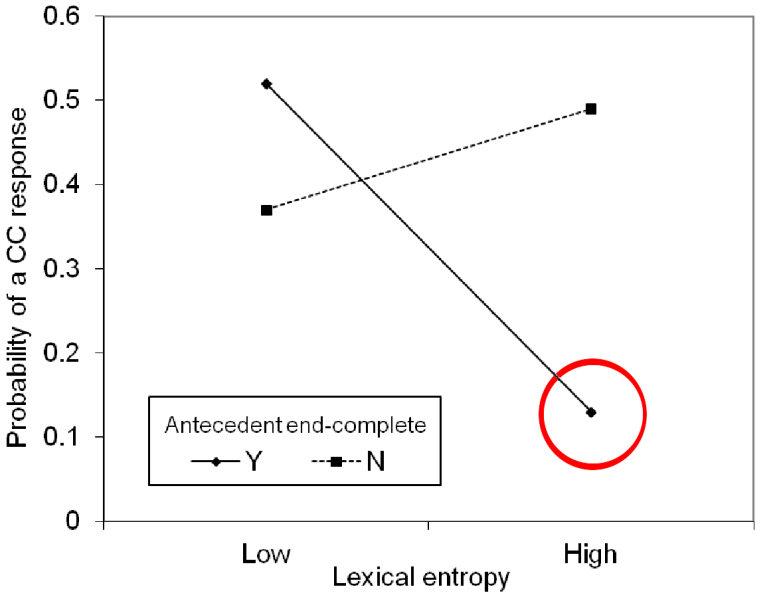

When the truncated turn is complete, responses are less likely to be continuations where the next word is unpredictable

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Potentially complete, highly predictable next word

W: I feel like we should be talking . . . ?

J: **about the prompt?**

W: about something important.

Compound contributions

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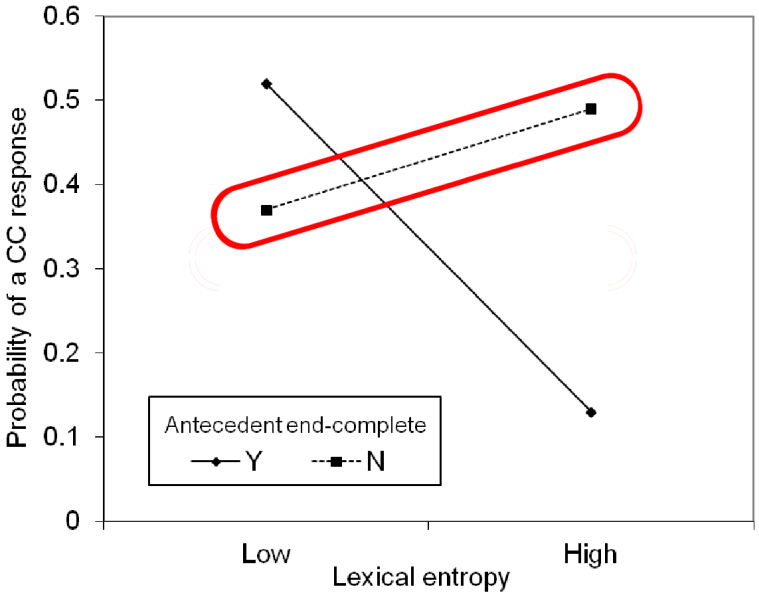

When the truncated turn is not complete there is no difference in proportion of CCs by predictability

Compound contributions

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Not potentially complete, highly predictable

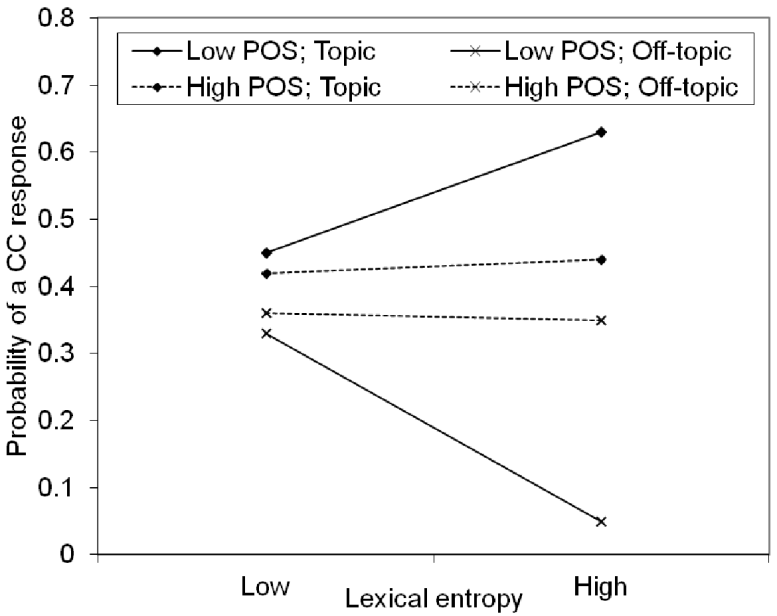
T: its not that fair on the girl doing th . . .

H: **exactly, you need to think of others and not be so selfish :P**

T: study we should do lots of chatting although i doubt she'll read past the exercise what with it not being standardised etc

Compound contributions by topic

- Coded for topic: is the interrupted turn on-topic or introducing something new?
- Three-way interaction: lexical entropy $\times$ POS entropy $\times$ topic.



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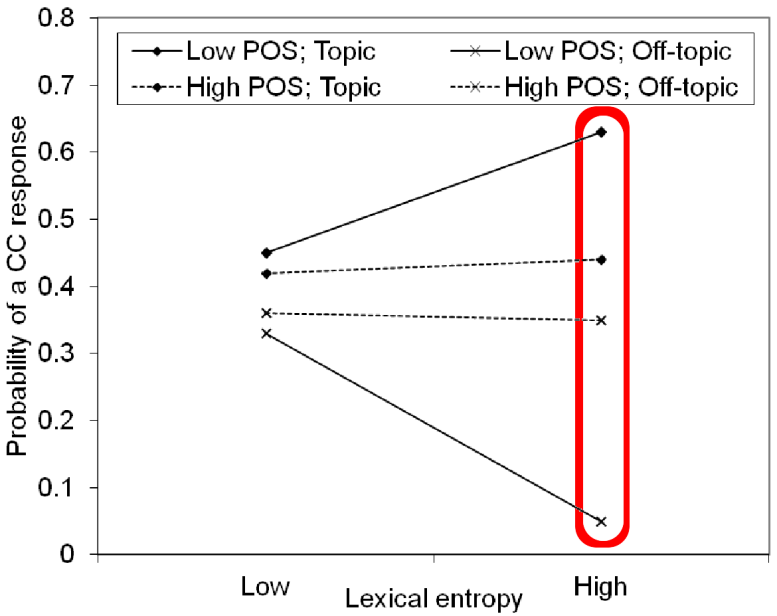

Topic really matters if the next lexical item is unpredictable and the syntactic category is predictable

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Cross-person continuations are more likely when they address topics that are part of the common ground. **TRUE**