Hammers and Nails in Linguistic Interaction

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ESSLLI 2015, Barcelona
Outline

1. Agreement and Disagreement
2. Power Asymmetries in Interaction
Part I: Agreement and Disagreement
Keeping Track of the Common Ground

- To maintain coherence in dialogue, speakers must keep track of their *common ground*.
- What is agreed upon? what is still under discussion?

Sometimes, this is easy:

1. A: That slogan is quite obvious.  
   B: I agree. / That’s not true.

Sometimes it is not at all trivial:

   B: I was never into those movies, either.
3. A: This is a very interesting design.  
   B: It’s just the same as normal.

[All examples from AMI and Switchboard corpora]
Keeping Track of the Common Ground

Sometimes it *seems* easy, but it is not . . .

(4) A: But it’s uh yeah it’s an original idea.  
B: Yes, it is.  \(\leadsto\) **acceptance**.

(5) A: A banana is not it’s not really handy.  
B: Yes, it is.  \(\leadsto\) **rejection**.

(6) A: It’s not very well advertised.  
B: No, it’s not.  \(\leadsto\) **acceptance**.

Although the responding utterance seems trivial, determining its dialogue function – **acceptance** vs. **rejection** – is not.

What’s at stake is how the **polarities** of **proposal & response** interact.
Logical polarity has not been explored in *computational approaches* 

It has seen renewed interest in *formal semantics* regarding polarity particles and negation 
Farkas & Roelofsen (2013), Cooper & Ginzburg (2013)

(7) A: Sue failed the exam.  
B: Yes she did. / No she didn’t.

(8) A: Sue did not pass the exam.  
B: Yes she did. / No she didn’t.

In classic semantics, A’s assertions have the same propositional content  
⇝ include polarity to account for different ‘meaning’ of yes / no.

Our aim: determine the *accepting* or *rejecting force* of a response.

Relative (dis)agreement: Formal Model

Basic model: assume a proposal $P$ is on the table. The next move $R$ accepts $P$ iff $P \land R$ is consistent.

Assign a polarity (pos/neg) to proposal and response, respectively:

- aligned polarities $\leadsto$ accepting force
- misaligned polarities $\leadsto$ rejecting force

$R$: relative agreement
- $P$ positive $\leadsto$ default case (positive-positive)
- $P$ negative $\leadsto$ reverse case (negative-negative)

$R$: relative disagreement
- $P$ positive $\leadsto$ default case (positive-negative)
- $P$ negative $\leadsto$ reverse case (negative-positive)

$R$: absolute agreement / disagreement
Empirical Study

How widespread is relative polarity in *actual dialogue*? Can our formal model be operationalised and have *practical value*?

Computational experiment:

- ~1300 $P-R$ pairs from two dialogue corpora (AMI & Switchboard) of which only 12% are rejections
- Task: identification of rejections
- Naive Bayes classifier with several standard features
- Use of surface-form heuristics for polarity assignment
- **Relative polarity boosts results substantially** (F-score increased from .52 to .60 in AMI and from .33 to .58 in SWB)
Some *logically consistent* responses may act as *rejections*:

(9) A: We are all mad, aren’t we?  
B: Well, some of us. \( \rightsquigarrow \) *not (necessarily) all of us*?


Many exchanges are not clearcut acceptances or rejections . . .

Crowdsourcing experiment: beyond gold-standard corpus annotations and our intuitions, *what does the crowd think?*

Please indicate which of the following options best captures what speaker B meant:

- • definitely / • possibly *agrees* with A
- • definitely / • possibly *disagrees* with A

(10) A: All drug dealers can be sentenced to the death sentence.  
B: Convicted drug dealers.  
\( \rightsquigarrow \) 25% disagreement category

(11) A: Let’s start with Dim Sum.  
B: Or have some vegetables.  
\( \rightsquigarrow \) 95% disagreement category
Part II: Power Asymmetries in Interaction
Speakers in dialogue tend to *adapt to each other* at different levels:

- phonetic production (Babel 2012, Kim et al., 2011)
- lexical choice (Brennan and Clark, 1996)
- syntactic constructions (Pickering and Ferreira, 2008)

What *causes* this adaptation is a matter of debate:

- the need for mutual understanding (Clark, 1996)
- priming (Pickering & Garrod, 2004)
- negotiating social distance (Giles, 2008)

**Focus today:** *social factors behind linguistic adaptation*
What kind of data?

We need a reasonably large corpus with social asymmetries amongst interacting agents

Turn to online communities

- community of Wikipedia editors
- some of them are administrators
- they interact via “talk pages”

User talk:Mackensen

From Wikipedia, the free encyclopedia

Canadian folk singer talk pages [edit]

....are being recreated. Would you mind deleting them again and salting them? Thank you, JNW (talk) 01:00, 14 June 2014 (UTC)

. Done. I've left the IP a friendly note. Mackensen (talk) 01:13, 14 June 2014 (UTC)

. Much appreciated. I noticed some of those talk pages had been deleted a half dozen times since 2012. Maybe a sneaky way of reintroducing deleted articles? JNW (talk) 01:16, 14 June 2014 (UTC)
Style Coordination

*How* things are said as opposed to *what* is said

визуally symbolizes *function words* are topic-independent (Pennebaker et al., 2007)

*pronouns, articles, quantifiers, prepositions, conjunctions, ...*

Editor$_a$: Corrected. Please check. **Any** more outstanding problems?
Editor$_b$: **Everything** is fine. Thanks a lot.

Coordination of $b$ towards $a$ for a class of function words $m$, for all pairs of utterances $(u_a, u_b)$ where $b$ directly replies to $a$:

$$C^m(b, a) = P(u_b \text{ uses } m \mid u_a \text{ used } m) - P(u_b \text{ uses } m)$$

Overall coordination towards $a$: average across all editors $b$ who address $a$ (adapted from Danescu-Niculescu-Mizil et al. 2012)

What about other more implicit forms of social power, such as how ‘central’ you are within the social network – do they impact linguistic style matching?

We want to construct a social network that reflects the linguistic interactions between the Wikipedia editors:

- nodes represent individuals in a community – Wikipedia editors
- edges give some measure of social connectivity between individuals – weighted according to the number of direct replies

Corpus: 342,800 posts, 26,397 editors (1,825 of whom are admins)
**Betweenness centrality:** How important are you to community connectivity?

\[
BC(n^*) = \sum_{n \neq m \in N} \frac{|\{\sigma \in \text{Path}(m, n) \mid n^* \in \sigma\}|}{|\text{Path}(m, n)|}
\]

where \(\text{Path}(m, n)\) is the set of shortest paths between \(m\) and \(n\)

**Eigenvector centrality:** How important are your neighbours?

\[
EC(n^*) = \frac{1}{\lambda} \sum_{n \in M(n^*)} EC(n)
\]

where \(M(n)\) is the neighbourhood of \(n\) and \(\lambda\) is the largest eigenvalue

**Highly central editors:** over one standard deviation above mean score.
Results

- More style coordination towards administrators.
- More style coordination towards editors in central social positions.

On average, admins occupy more central positions, but the impact of adminship and centrality turn out to be largely independent...
• Low-centrality editors receive more coordination if they are admins.
• But adminship is less important for high-centrality users.

\[ \text{Low centrality} \]

\[ \text{High centrality} \]

\[ \text{Eigenvector Admins} \]
\[ \text{Eigenvector Non-Admins} \]
\[ \text{Betweenness Admins} \]
\[ \text{Betweenness Non-Admins} \]

\[ \rightsquigarrow \text{social network centrality} \] sometimes eclipses status-based power in triggering linguistic style adaptation.
Open Issues . . .

Is adaptation to central users (rather than admins) more important for *social acceptance*?

- how does this happen even though centrality is more *implicit*?
- do highly central users exhibit speech *more typical* of the community?

Several *practical applications* within computational social science:

- automatic discovery of social relations,
- tracking evolution of relations over time, . . .
Part III: Child-Adult Dialogue
Coordination in Child-Adult Dialogue

child → adult  language learning
child ← adult  child-directed speech

input  vs.  interaction
sensitivity to statistical regularities in the input ignoring interaction
sensitivity to when & how the input is offered in interaction

Adult: Help me put your toys away, darling.
Child: I’m going to Colin’s and I need some toys.
Adult: You don’t need a lot of toys.
Child: Only a little bit toys.
Adult: You only need a few.
Child: Yes, a few toys.

Focus here: ways of investigating how speakers pick up on each other’s language (coordinate) at different degrees of locality.
Two-party dialogue transcript

A_1: which one do you want first  
B_1: that one  
A_2: you like this one  
B_2: yeah, give me  
...  
A_n: ...  
B_n: ...

Recurrence (coordination) score for each (i, j)

- **global recurrence**: average coordination over all turn pairs
- **local recurrence**: recurrence in (semi-)adjacent turns, separated by at most distance $d < n$ (diagonal line of incidence)
- **upper recurrence**: child’s turn comes after adult’s $\text{adult} \leftarrow \text{child}$
- **lower recurrence**: adult’s turn comes after child’s $\text{child} \leftarrow \text{adult}$
Turn-based Cross-Recurrence Plots

CRP of a dialogue with Abe (2.5 years old):

Same *global* recurrence but very different *local* recurrence

⇝ global: chance recurrence regardless of temporal development of interaction
Measuring Recurrence

Many measures are possible: lexical, conceptual, syntactic,…


**Syntactic coordination**: number of shared part-of-speech bigrams factoring out lexical identity, normalised by length of longest turn.

Adult: you are pressing a button and what happens ?

Child: what happens the horse tail
**Results**

**Data:** 380 dialogues from 3 children over a period of $\sim$3 years. For comparison: $\sim$1000 adult-adult dialogues from Switchboard.

- **local vs. global:** significantly more local coordination.

- **directionality:** both coordinate more at local levels, but the adult recurs with the child significantly more.

- **difference with adult dialogue:** very different coordination patterns, with adults showing syntactic divergence at adjacent turns $\leadsto$ less recurrence than expected by chance.
Contrast with previous evidence of syntactic alignment in adult-adult dialogue (e.g., Pickering & Ferreira 2008), but not surprising advancing a conversation requires different dialogue acts with distinct syntactic patterns.

Why is there syntactic recurrence in child-adult dialogue?
- feedback mechanism to ratify linguistic constructions?
- possibly related to corrective feedback

```
Child: you’re good at sharing.
Mother: I’m good at sharing?
```


Ultimate question: to what extent does interaction contribute to language acquisition?
Recap

1. Agreement and Disagreement
2. Power Asymmetries in Interaction

logic, machine learning, crowdsourcing, corpus studies, social network analysis, recurrence quantification analysis, ...
Thanks!

Julian Schlöder  Bill Noble  Sarah Hiller  Robert Grimm

I’m hiring: 1 PhD & 1 postdoc
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Marie Curie Initial Training Network

Take a look at SIGdial conference, SemDial workshop, Dialogue & Discourse journal