Computational Semantics and Pragmatics

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Outline

- Today: Alignment and convergence
- Thursday: Discussion on research papers / annotation task
- Next week:
  - Dynamic semantics for dialogue
  - Propose a project topic
- Week after next: individual supervision meetings

Acknowledgement: these slides are based on a keynote talk by Holly Branigan at SemDial 2014.

Alignment in Interaction

When people interact, they converge on common ways of behaving:



Gestures, facial expressions, foot tapping, postural sway



Even when it may run counter to one's interests

Alignment of linguistic behaviour

Speakers align their language in many ways: "imitation" of aspects of partner's language

- Alteration in likelihood of particular language behaviour
- May be dynamic adjustment to partner's most recent contribution
- Or gradual alignment during (and beyond..) interaction
- Found in both experimental and natural interactions of many kinds, in many languages

Alignment at different linguistic levels

Phonology/phonetics: speech rate, response latencies, vocal intensity, pronunciation, pausing patterns

Lexicon (word choice): *shoe* vs. *pennyloafer*



Syntax: If your partner uses a syntactic structure, you are more likely to use it too.

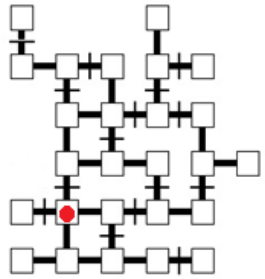
The nun is giving a book to the clown (V NP PP) vs.
The nun is giving the clown a book



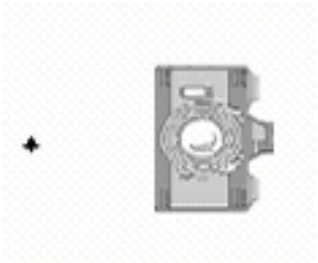
The cowboy is giving the banana to the burglar vs.
The cowboy is giving the burglar the banana

Alignment at different linguistic levels

Semantics: dialogue partners converge on semantic conceptualisations



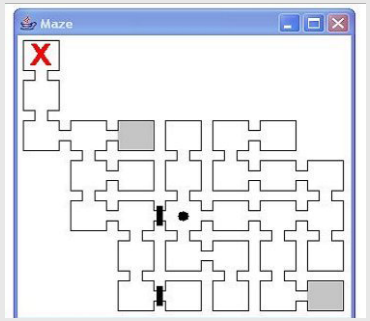
Description schemas: *I'm at B5* vs.
I'm at second column, second row from the bottom



Reference frames: *The dot is below the camera* vs.
The dot is to the left of the camera

Alignment at different linguistic levels

Semantics: dialogue partners converge on semantic conceptualisations



Pattern of semantic shift:

0 mins: The piece of the maze sticking out
2 mins: The left hand corner of the maze
5 mins: The northenmost box
10 mins: Leftmost square of the row on top
15 mins: 3rd column middle square
20 mins: 3rd column first square
25 mins: 6th row longest column
30 mins: 6th row 1st column
40 mins: 6 r, 1 c
45 mins: 6, 1

Reversion to figurative model after clarification:

A: I'm in the 4th row 5th square.
B: Where's that?
A: The end bit.
B: I'm on the end bit right at the top.

Existing experimental data shows that participants systematically favour Figural and Path descriptions when encountering problematic dialogue

Garrod and Doherty (1994) Conversation, co-ordination and convention: an empirical investigation of how groups establish linguistic conventions. *Cognition*, 53:181-215.

Mills and Healey (2008) Semantic negotiation in dialogue: mechanisms of alignment, in *Proceedings of SIGdial*.

Alignment in human-computer interaction

Humans also align with artificial dialogue partners.

- Alignment of lexical choice in routefinding task (Koulouri, Lauria & Macredie, 2014) :

  `Robot: I am at the junction by the bridge, facing the bendy road.`

  `User: Go into the bendy road.`

- Kid's speech alignment with animated characters (Coulston, Oviatt & Darves, 2002):
  - greater amplitude with louder 'extrovert' character
  - smaller with quieter 'introvert' character

Exploiting alignment in HCI

Alignment reduces the space of possible user behaviours. This can help HCI by

- implicitly shaping the user's input in a way that the system can understand: eliciting specific behaviour (word choice, grammatical structures, speech rate, amplitude. . .)
- predicting user input

System's alignment with the user: generating more naturalistic output

- Users expect that the conversational partner will align
- Increasing user satisfaction

Why do people align language?

Important distinctions:

- goal directed *vs* non-goal directed
- explicit strategic process: deliberate, reasoned *vs*
  implicit automatic process: without awareness, unreasoned

If alignment is non-goal directed, the process must be implicit and automatic.

If it is goal directed, the process may be explicit or implicit.

Current theories of alignment

Three different approaches:
communicative *vs* social *vs* architectural explanations

- Alignment is goal-directed
  - Communicative goals
  - Social goals
- Alignment is non-goal-directed
  - Consequence of cognitive architecture

Alignment is driven by communicative goals

Speakers align to maximise mutual understanding.

- Appeal to common ground (joint action model by Clark et al.)
- Communicative design: *what is my interlocutor likely to understand?*

Alignment:

- driven by the desire to be understood, to reach mutual understanding
- leads to more successful communication

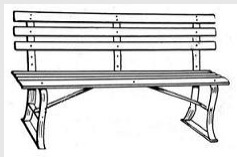
Goal: communicative success

- explicit goal?
- it requires a model of the dialogue partner as communicative agent (usually explicit)

Evidence

- Partner-specific conceptual pacts
- Referential task (lexical choice)

$> 15\%$ chance to use *'seat'* in null context



If partner uses *'seat'*:

– 83% alignment when thinking partner is a computer

– 44% alignment when thinking partner is a human

– 80% alignment when thinking partner is an basic computer – 42% alignment when thinking partner is an advanced computer

More lexical alignment with 'less capable' partner (Branigan et al. 2011)

Communicative beliefs affect lexical alignment.

Alignment is driven by social goals

Speakers align to socially index and achieve rapport with conversational partners.

- Communication accommodation theory (Giles et al.)

Alignment:

- driven by affiliation, desired to be liked, need for social approval
- leads to more likeable perception, more acceptance/compliance

Goal: enhancement of social relations

- usually implicit goal? (triggered by contextual features)
- it requires a model of the dialogue partner as social agent (usually implicit)

Evidence

- Speech rate alignment implicitly increases compliance with requests (Buller & Aune 1992)
- Repetition increases waiters' tips (Van Baaren et al. 2003)
- More alignment towards high-powered partners (paper for Thursday by Danescu-Niculescu-Mizil et al. 2012)

Alignment is due to our cognitive architecture

Alignment is a natural consequence of the architecture of our cognitive system.

- Interactive alignment model (Pickering & Garrod 2004)

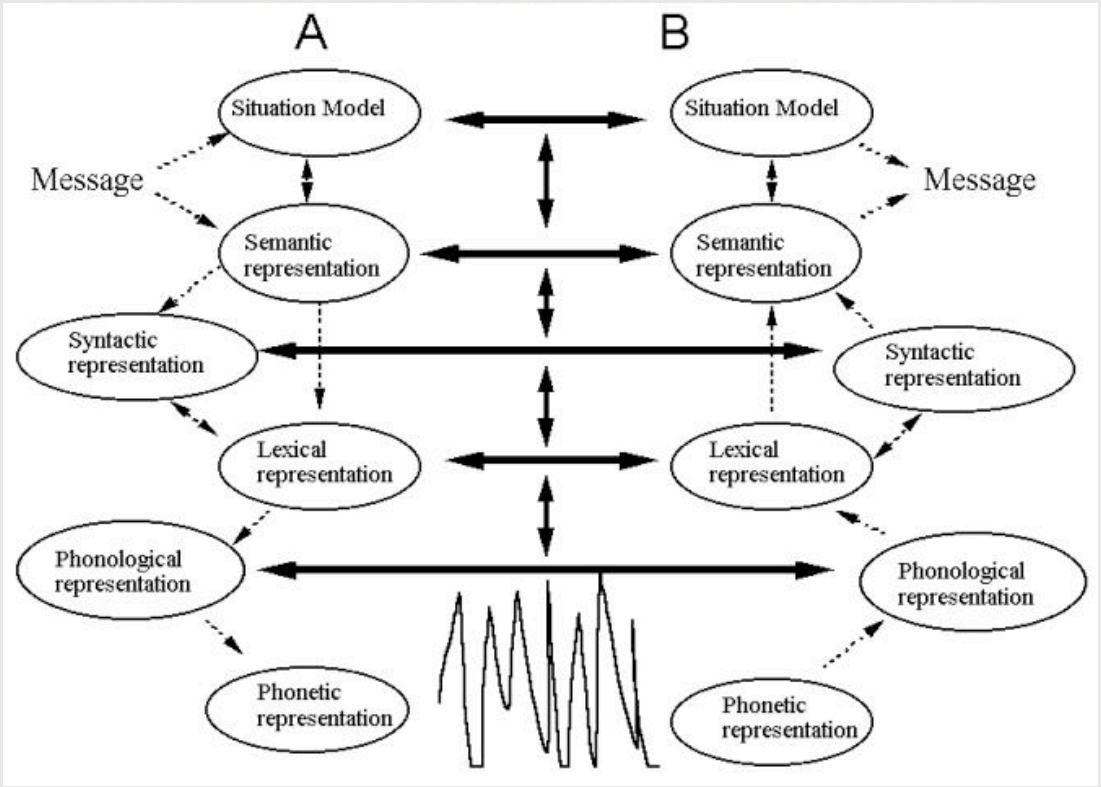
Alignment:

- driven by activated linguistic representations – priming (stimulus, response)
- leads to reduction of cognitive lead, and indirectly to successful communication

It is not goal directed.

- implicit and automatic (triggered by linguistic features)
- no representation of partner required

Interactive alignment model



(Pickering & Garrod 2004)

- Priming operates on representations at every level
- Alignment at one level enhances alignment at other levels
  e.g., syntactic alignment is enhanced by lexical / semantic overlap
- Alignment of situation models leads to successful communication

Evidence

- Syntactic alignment
- Syntactic alignment with lexical boost

nun **giving** a book to a clown (V NP PP rather than "nun giving a clown a book")
→ "sailor **showing** a hat to a girl"; more priming with "sailor **giving** a hat to the girl"

the **sheep** that's red (Relative Clause rather than "the red sheep")
→ "the **book** that's red"; more priming with "the **goat** that's red"

- Same level of syntactic alignment under differing beliefs – believing partner is human (66%) vs computer (64%) (Branigan et al. in preparation)

Overall evidence

- Communicative-goal-directed mechanisms
  often potentially explicit (reasoned)
- Social-goal-directed mechanisms
  often potentially implicit (automatic)
- Non-goal-directed mechanisms
  implicit (automatic), triggered by exposure to language

A lot of evidence is consistent with all three explanations

Most research does not seek to contrast accounts: different tasks, different contexts, different partner behaviour.

No single account explains the full range of evidence.

Are theories complementary?

Possible integrated account: alignment as a multi-componential phenomenon (Holly Branigan)

- Outcome of fundamental implicit non-goal-directed processes and contingent implicit or explicit goal-directed processes.
- Explicit processes act by modulating outcome of implicit processes:
  - implicit processes alter underlying response likelihood
  - explicit processes can act on these altered likelihoods
- Different aspects of language may vary in susceptibility to explicit control.

Papers for discussion on Thursday

D. Reitter and J. Moore (2007). Predicting Success in Dialogue, *Proc. 45th Annual Meeting of the Association of Computational Linguistics (ACL)*.

C. Danescu-Niculescu-Mizil, L. Lee, B. Pang and J. Kleinberg (2012). Echoes of power: Language effects and power differences in social interaction, *Proceedings of WWW*.