

Towards a computational model of frame of reference alignment in dialogue

Simon Dobnik, Christine Howes and John D
Kelleher

CLASP centre for
linguistic theory
and studies in probability

Joint Action Meeting (JAM 7)
Tuesday 25th July, 2017



UNIVERSITY OF GOTHENBURG

Outline

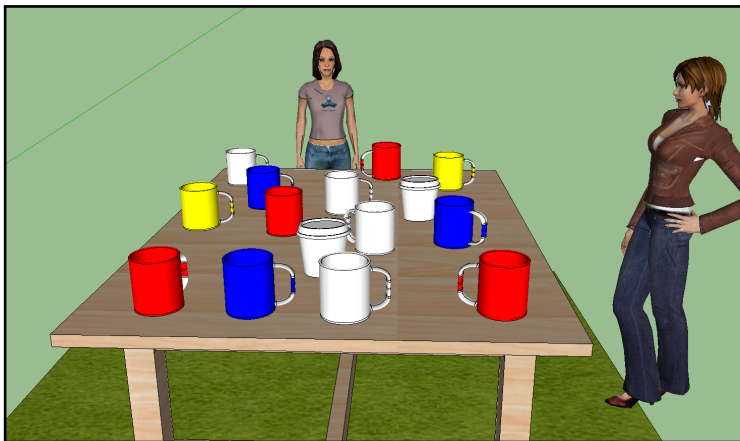
- 1 Frame of reference and alignment
- 2 A corpus of free spatial dialogue
- 3 FoR alignment and change
- 4 Conclusions



- 1 Frame of reference and alignment
- 2 A corpus of free spatial dialogue
- 3 FoR alignment and change
- 4 Conclusions



Where is the yellow mug?



Situated dialogue systems



Situated dialogue systems



Alignment and FoR

- Interactive alignment model (Pickering and Garrod, 2004)



Alignment and FoR

- Interactive alignment model (Pickering and Garrod, 2004)
- Evidence for FoR alignment in dialogue



Alignment and FoR

- Interactive alignment model (Pickering and Garrod, 2004)
- Evidence for FoR alignment in dialogue
 - Picture description tasks



Alignment and FoR

- Interactive alignment model (Pickering and Garrod, 2004)
- Evidence for FoR alignment in dialogue
 - Picture description tasks
 - Watson et al. (2004)



Alignment and FoR

- Interactive alignment model (Pickering and Garrod, 2004)
- Evidence for FoR alignment in dialogue
 - Picture description tasks
 - Watson et al. (2004)
 - Johannsen and de Ruiter (2013)



Alignment and FoR

- Interactive alignment model (Pickering and Garrod, 2004)
- Evidence for FoR alignment in dialogue
 - Picture description tasks
 - Watson et al. (2004)
 - Johannsen and de Ruiter (2013)
 - Dobnik et al. (2014)



Alignment and free dialogue

- Interactive alignment hypothesis:
interlocutors converge on a FoR
- However...
 - ... people diverge syntactically (Healey et al., 2014)
 - ... clarification requests decrease convergence (Mills and Healey, 2006)
- Description types driven by mutual understanding and strategies for resolution of misunderstanding.



Hypotheses

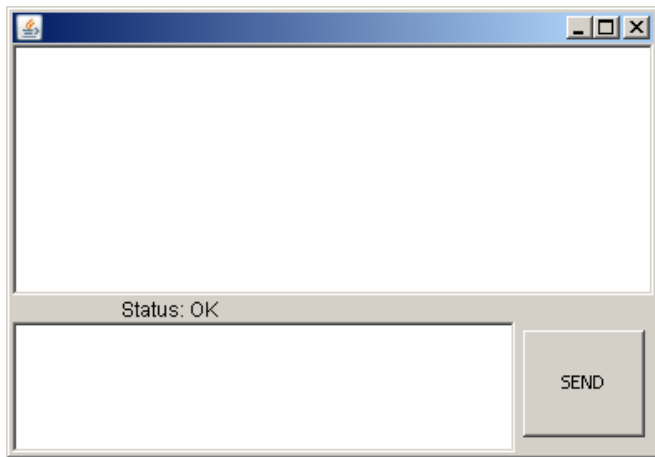
- (1) There is no baseline preference for a specific FoR
- (2) Participants will align on spatial descriptions over the course of the dialogue
- (3) Sequences of misunderstanding will prompt the use of different FoRs



- 1 Frame of reference and alignment
- 2 A corpus of free spatial dialogue**
- 3 FoR alignment and change
- 4 Conclusions



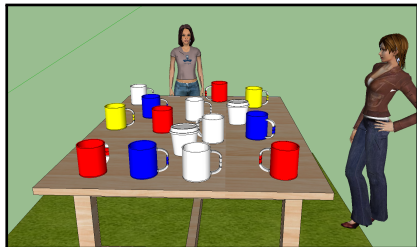
The DiET chat tool



The task



The views



View for participant 1



View for participant 2

Annotation scheme

Tag	Value	Explanation
is-spatial	y/n	For all turns: does this turn contain a spatial description
viewpoint	category	Where <code>is-spatial=y</code> : what view-point does the FoR use? P1, P2, Katie, object, extrinsic
explicitness	y/n	Where <code>is-spatial=y</code> : whether the FoR is explicitly referred to, e.g. “on my left”
repair	y/n	The utterance is a repair
acknowledgement	y/n	The utterance is an acknowledgement

$\kappa = 0.8121$, first 100 turns of P1 and first 105 of P2



Example

- 20 P1: from her right I see yell, white, blue red
spatial, relative-katie, explicit
- 21 and the white has a funny thing around the top
- 22 P2: then you probably miss the white i see
- 23 P1: and is between yel and bl but furhter away from katie
spatial, relative-katie, explicit
- 24 P2: because i see a normal mug too, right next to the yellow
one, on the left **spatial, relative-katie**
- 25 P1: ok, is your white one closer to katie than the yellow and
blue?
spatial, relative-katie
- 26 P2: yes
- 27 closest to me, from right to left:
spatial, relative-p2
- 28 P1: ok, got it



Overview of data

Dialogue	Language	Native	Duration (min)	Length (turns)
#1	English	Swedish	≈30	157
#2	English	British	≈60	441
Total	English			598
#4	Swedish	Swedish	≈30	75
#5	Swedish	Swedish	≈60	163
#6	Swedish	Swedish	≈60	248
#7	Swedish	Swedish	≈60	308
Total	Swedish			794
Total	All			1392



- 1 Frame of reference and alignment
- 2 A corpus of free spatial dialogue
- 3 FoR alignment and change**
- 4 Conclusions



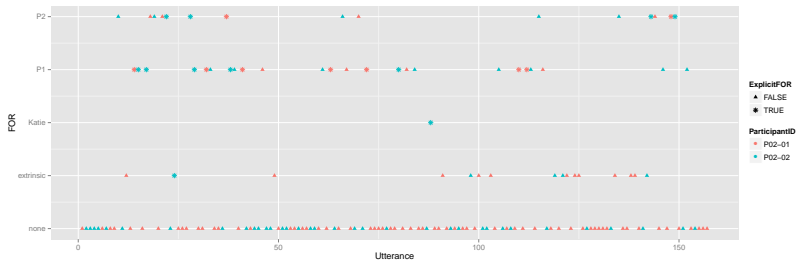
Overview of results

Category	English		Swedish	
	Turns	%	Turns	%
Contains a spatial desc.	245	40.97	273	34.38
FoR=P1	88	35.92	122	44.69
FoR=P2	66	26.94	83	30.40
FoR=speaker	81	33.06	107	39.19
FoR=addressee	72	29.39	98	35.90
FoR=Katie	15	6.12	52	19.05
FoR=extrinsic	61	24.90	38	13.92
Total turns	598		794	

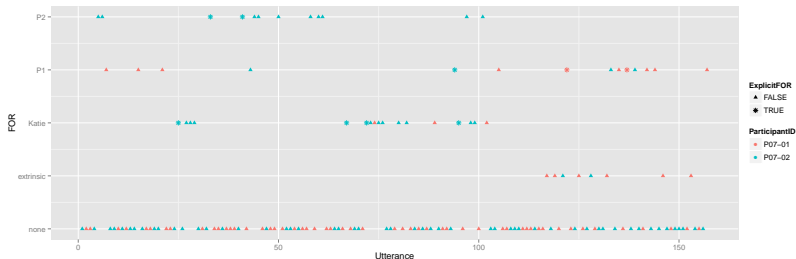


Results: Local alignment

English P2



Swedish P7



Results: Local alignment

- Participants tend to align to FoR over several turns
- Partial auto-correlations on each binary FoR variable: P1, P2, Katie and Extrinsic
 - Each correlates positively with itself ($p < 0.05$) at 1-3 (English) and 1-2 (Swedish) turns lag
 - use of a particular FoR makes reuse of that FoR more likely
- No significant cross-correlations between the variables in English data
- Significant cross-correlations between P2 and Katie in Swedish data



Clarification and repair

Information and precision

- Misunderstandings prompt changes in FoR
- These may include over specification
- Not just information giver adapting to receiver (contra Schober, 1995)



Clarification and repair

Information and precision

- Misunderstandings prompt changes in FoR
- These may include over specification
- Not just information giver adapting to receiver (contra Schober, 1995)

36 *P1: okej, nästa rad mot mitten*

37 *P1: från mitt håll står det en take-away bakom den vita muggen*

38 *P1: snett vänster om*

39 *P2: Ok. Här det en vanlig vit mugg strax till höger om den vita närmast dig.*

40 *P2: Till höger och innåt bordet då.*

41 ***P1: höger för dig eller mig?***

42 *P2: För dig.*

43 *P1: okej, den ser jag*



Clarification and repair

14 *P1*: On my first row. I have from the left (your right): one red, handle turned to you but I can see it. A blue cup next. Handle turned to my right. A white with handle turned to right. Then a red with handle turned to my left.

15 ***P2*: first row = row nearest you?**

16 *P1*: Yes.

17 *P2*: ok then i think we found a cup of yours that i can't see: the red with the handle to your left (the last one you mention)

18 *P1*: Okay, that would make sense. Maybe it is blocked by the other cups in front or something?

19 *P2*: yeh, i have a blue one and a white one, either of which could be blocking it

20 *P1*: Yes, I think I see those.

...

26 ***P1*: You know this white one you just mentioned. Is it a takeaway cup?**

28 *P2*: no, i was referring to the white handled cup to the right of the blue cup in the second row from you. its handle faces... south east from my perspective

29 *P2*: the second row of cups from your end

30 *P1*: Yes, I understand now!



Clarification and repair

55 P2: okej, fortsätter längs kanten på vänster sida?

56 **P1: vems perspektiv?**

57 P2: Katies

58 P1: okej på kates vänstra sida innåt framför dig finns det en
röd mugg

59 P1: ditt höger



Clarification and repair

- 55 P2: okej, fortsätter längs kanten på vänster sida?
- 56 **P1: vems perspektiv?**
- 57 P2: Katies
- 58 P1: okej på kates vänstra sida innåt framför dig finns det en
röd mugg
- 59 P1: ditt höger
- 60 P1: nej vänster
- 61 **P2: va??**
- 62 P1: hahaha
- 63 P2: okej närmast mig då
- 64 P2: längst från dig, och Katies högra sida
- 65 P1: japp snätt åt vänster framför dig
- 66 P1: ditt vänster dvs
- 67 P2: röd, sen vit med lock, sen vit med öra i mitt nedre högra
hörn
- 68 P1: vi tar ditt perspektiv nu tycker jag, OKEJ!
- 69 P2: OKEJ
- 70 P1: ;)
- 71 P1: jag har bra perspektiv



- 1 Frame of reference and alignment
- 2 A corpus of free spatial dialogue
- 3 FoR alignment and change
- 4 Conclusions**



Conclusions

- Pilot study in how FoR is negotiated over several turns of free dialogue
- English and Swedish
 - no baseline preference for a specific FoR
 - no general alignment of FoR over dialogue but local alignment
 - misunderstandings associated with FoR change
 - FoR appears to be dependent on the dialogue game participants are engaged in



Conclusions

- Pilot study in how FoR is negotiated over several turns of free dialogue
- English and Swedish
 - no baseline preference for a specific FoR
 - no general alignment of FoR over dialogue but local alignment
 - misunderstandings associated with FoR change
 - FoR appears to be dependent on the dialogue game participants are engaged in
- Driven by local resolution of (potential) misunderstandings



Future work

- Collect more data
- Add semantic and discourse features that would allow computational modelling of FoR assignment
- Statistical tests for features indicative of FoR change
- FoR tagger for dialogue systems

References I

- Dobnik, S., J. D. Kelleher, and C. Koniaris (2014, 1–3 September). Priming and alignment of frame of reference in situated conversation. In V. Rieser and P. Muller (Eds.), Proceedings of DialWatt - Semdial 2014: The 18th Workshop on the Semantics and Pragmatics of Dialogue, Edinburgh, pp. 43–52. ISSN 2308-2275, 10 pages, contribution: 80%.
- Healey, P. G. T., M. Purver, and C. Howes (2014, June). Divergence in dialogue. PLoS ONE 9(6), e98598.
- Johannsen, K. and J. de Ruiter (2013). Reference frame selection in dialogue: priming or preference? Frontiers in Human Neuroscience 7(667), 1–10.
- Mills, G. and P. G. T. Healey (2006, September). Clarifying spatial descriptions: Local and global effects on semantic co-ordination. In Proceedings of the 10th Workshop on the Semantics and Pragmatics of Dialogue (SEMDIAL), Potsdam, Germany.



References II

- Pickering, M. and S. Garrod (2004). Toward a mechanistic psychology of dialogue. Behavioral and Brain Sciences 27, 169–226.
- Schober, M. F. (1995). Speakers, addressees, and frames of reference: Whose effort is minimized in conversations about locations? Discourse Processes 20(2), 219–247.
- Watson, M. E., M. J. Pickering, and H. P. Branigan (2004). Alignment of reference frames in dialogue. In Proceedings of the 26th annual conference of the Cognitive Science Society, pp. 2353–2358. Lawrence Erlbaum Mahwah, NJ.

