Interjection as coordination device: Feedback Relevance Spaces

Arash Eshghi[1]
(Joint work with Christine Howes[2])

[1]Interaction Lab
School of Mathematical and Computer Sciences
Heriot-Watt University, Edinburgh
a.eshghi@hw.ac.uk

[2]Centre for Linguistic Theory and Studies in Probability
Department of Philosophy, Linguistics & Theory of Science
University of Gothenburg, Gothenburg
christine.howes@gu.se

Overview

Overview

Dialogue. . .

A	5143	He did mashed potatoes
J	5144	Mm.
A	5145	cabbage, savoy cabbage, carrots ⟨pause⟩ and he'd cu- cut them like I always cut them cos they were only them little baby carrots so, what I do I slice them down
J	5146	Yeah.
A	5147	you know, down middle like
J	5148	Yeah.
A	5149	into quarters so I do them longer
J	5150	Yeah.
A	5151	and he'd done them like that in microwave for eight minutes ⟨pause⟩ and er, done sprouts ⟨pause⟩ then he'd put this meat pie in oven
J	5152	Crikey!
A	5153	and er, done onion gravy!
J	5154	Mm mm!
A	5155	I says, ooh this gravy's lovely!
J	5156	Yeah!
A	5157	He says er, yeah he said I did some onion, and then, I got some of them, you know
J	5158	Granules?
A	5159	yeah, put some of that in
J	5160	Mm.

Dialogue. . .

- is incremental
- and co-constructed (Clark, 1996; Goodwin, 1981)
- even if one person does most of the talking

  (Bavelas et al., 2000)

- listener feedback:
  - backchannels (*mmm*, *uh-huh*)
  - Clarification Requests (CR, e.g. *huh?*, *Mary?*)
  - (also non-verbal, such as nodding or looking puzzled)
- impacts on how the conversation unfolds

Feedback - backchannels & CRs. . .

- can occur sub-sententially
- evidence suggests that there are specific places where they ought to occur
- *backchannel relevance spaces* (Heldner et al., 2013)
  - analogous to transition relevance places (Sacks et al., 1974)

    . . . but more common
- feedback is optional at these points

Randomly placed feedback. . .

- is disruptive
- is rated as less natural
- decreases rapport
- makes a robot listener seem less attentive

(Healey et al., 2011; Poppe et al., 2011; Kawahara et al., 2016; Park et al., 2017)

Backchannels as repair avoidance?

"...'uh huh', nods, and the like, in passing the opportunity to do a full turn at talk, can be seen to be passing an opportunity to initiate repair on the immediately preceding talk" (Schegloff, 1982)

- Primacy of the mis-: understanding consists in not having misunderstandings

  (in line with Healey et al., 2018)
- Multiple backchannel functions – continuer, agreement, acknowledgement – unifiable
- Feedback = procedural devices for managing divergence and convergence in dialogue

Feedback Relevance Spaces (FRS)

- Points at which a semantic unit has just been completed
- Like Transition Relevance Spaces

Feedback Relevance Spaces (FRS)

- Points at which a semantic unit has just been completed
- Like Transition Relevance Spaces

  ... but more common

Feedback Relevance Spaces (FRS)

- Points at which a semantic unit has just been completed
- Like Transition Relevance Spaces

  ... but more common
- Hypothesis:
  - feedback *ought* to occur just after a complete semantic unit
  - constraints on timing of backchannels & CRs should be similar
- Feedback at these points is optional

Feedback Relevance Spaces (FRS)

- Points at which a semantic unit has just been completed
- Like Transition Relevance Spaces

  ... but more common
- Hypothesis:
  - feedback *ought* to occur just after a complete semantic unit
  - constraints on timing of backchannels & CRs should be similar
- Feedback at these points is optional
- A dialogue grammar should capture this...
- and make predictions about what happens otherwise

Overview

Hypotheses

1. Feedback should ordinarily occur at FRSs
2. Early feedback indicates that the speaker's truncated semantic unit was locally predictable enough to be already understood without having been fully articulated.
3. Late feedback is more disruptive than feedback at FRS & early feedback
4. Backchannels at non FRSs are less disruptive than CRs

Materials & Annotations

- 20 dialogues from the sub-corpus of the BNC used to study Compound Contributions

  (Purver et al., 2009; Howes et al., 2012a)
- existing `end-complete` tags
- additional annotations of CRs & backchannels
- additional annotations of FRS, Early & Late feedback (following Duncan, 1972; Kjellmer, 2009)
- Late feedback annotated conservatively

Positioning of Feedback: Results

	Total		at TRP		overlap	
	#	%	#	%	#	%
Acknowledgements	655	*13*	112	*17*	174	*27*
Clarification	115	*2*	10	*9*	14	*12*
Total	770	*16*	122	*16*	188	*24*
Total utterances	4938					

Positioning of Feedback: Results

	Total		at TRP		overlap	
	#	%	#	%	#	%
Acknowledgements	655	*13*	112	*17*	174	*27*
Clarification	115	*2*	10	*9*	14	*12*
Total	770	*16*	122	*16*	188	*24*
Total utterances	4938					

- Backchannels more likely than CRs to occur at TRP (17% vs 9%: $\chi^2_1 = 5.181, p = 0.02$)

Positioning of Feedback: Results

	Total		at TRP		overlap	
	#	%	#	%	#	%
Acknowledgements	655	*13*	112	*17*	174	*27*
Clarification	115	*2*	10	*9*	14	*12*
Total	770	*16*	122	*16*	188	*24*
Total utterances	4938					

- Backchannels more likely than CRs to occur at TRP (17% vs 9%: $\chi^2_1 = 5.181, p = 0.02$)
- Backchannels more likely to occur in overlap than CRs (27% vs 12%: $\chi^2_1 = 10.978, p = 0.001$)

Positioning of Feedback: Results

	Total	Early		At FRS		Late	
	#	#	%	#	%	#	%
Acknowledgements	655	81	*12*	555	*85*	19	*3*
Clarifications	115	7	*6*	99	*86*	9	*8*
Total	770	88	*11*	654	*85*	28	*4*

Positioning of Feedback: Results

	Total	Early		At FRS		Late	
	#	#	%	#	%	#	%
Acknowledgements	655	81	*12*	555	*85*	19	*3*
Clarifications	115	7	*6*	99	*86*	9	*8*
Total	770	88	*11*	654	*85*	28	*4*

- No difference at FRS (85% vs 86%)

Positioning of Feedback: Results

	Total	Early		At FRS		Late	
	#	#	%	#	%	#	%
Acknowledgements	655	81	*12*	555	*85*	19	*3*
Clarifications	115	7	*6*	99	*86*	9	*8*
Total	770	88	*11*	654	*85*	28	*4*

- No difference at FRS (85% vs 86%)
- Backchannels more likely to be early (12% vs 6%)
- CRs more likely to be late (8% vs 3%:

  $\chi^2_1 = 10.452, p = 0.001$)

Late Feedback

- addresses an earlier semantic unit

D 136 Er women were also said to be polite, diffident, verbose and deferential, which
U 137 What all of those?
D 138 Mhm.
U 139 ⟨unclear⟩ polite and deferential.

Late Feedback

- more CRs than backchannels are late
- more disruptive than feedback at FRS?
  - restarts more common following late feedback than feedback at an FRS (25% vs 10% $\chi^2_1 = 6.244, p = 0.012$)
  - restarts maybe more common following late feedback than early feedback (25% vs 11% $\chi^2_1 = 3.158, p = 0.076$)

Early Feedback

- Predictability of speaker's utterance

Early Feedback

- Predictability of speaker's utterance: interpreted as if complete

M	180	I can't stand the seaside.
	181	Couldn't we go to the North York [Moors]
L	182	[Mm.]
M	183	instead.
	184	Right so . . .

Early Feedback

- CR produced as a completion

J 109 How does it generate?
M 110 It's generated with a handle and
J 111 **Wound round?**
M 112 Yes, wind them round and this should, should generate a charge . . .

Early Feedback

- 14% of early vs. 5% of late backchannel antecedents are abandoned
- for CRs, the opposite: 14% of early vs. 67% of late CR antecedents are abandoned
- Early CRs are often produced as completions (~60%)
- results in line with Healey et al. (2011); Howes et al. (2012b)

Early Feedback

- Abandoned antecedent

S	66	Yeah ⟨pause⟩ Well it's it's it's a it's a bit of a weighty subject that.
	67	**I think we ought to er**
B	68	Yeah okay
S	69	Why don't you and I talk about it separately then
B	70	Yeah alright

Late backchannel

- backchannel leads to restart

D 144 I'm not saying that the same person thought of these two things at once, but
U 145 Okay.
D 146 these are these are things which were all said.

Overview

Dynamic Syntax and Type Theory with Records (DS-TTR)

- An inherently incremental, action-based, semantic grammar framework (Kempson et al., 2001; Cann et al., 2005)

Dynamic Syntax and Type Theory with Records (DS-TTR)

- An inherently incremental, action-based, semantic grammar framework (Kempson et al., 2001; Cann et al., 2005)
- No intermediate level of syntactic processing

Dynamic Syntax and Type Theory with Records (DS-TTR)

- An inherently incremental, action-based, semantic grammar framework (Kempson et al., 2001; Cann et al., 2005)
- No intermediate level of syntactic processing
- Word-by-word construction of semantic (and contextual) representations in Type Theory with Records (TTR Cooper, 2012)
- syntax = **constraints** on incremental semantic construction
- grammar = set of **conditional actions** for incremental, semantic processing

Dynamic Syntax and Type Theory with Records (DS-TTR)

- An inherently incremental, action-based, semantic grammar framework (Kempson et al., 2001; Cann et al., 2005)
- No intermediate level of syntactic processing
- Word-by-word construction of semantic (and contextual) representations in Type Theory with Records (TTR Cooper, 2012)
- syntax = **constraints** on incremental semantic construction
- grammar = set of **conditional actions** for incremental, semantic processing
- Bidirectional (generation as parsing)

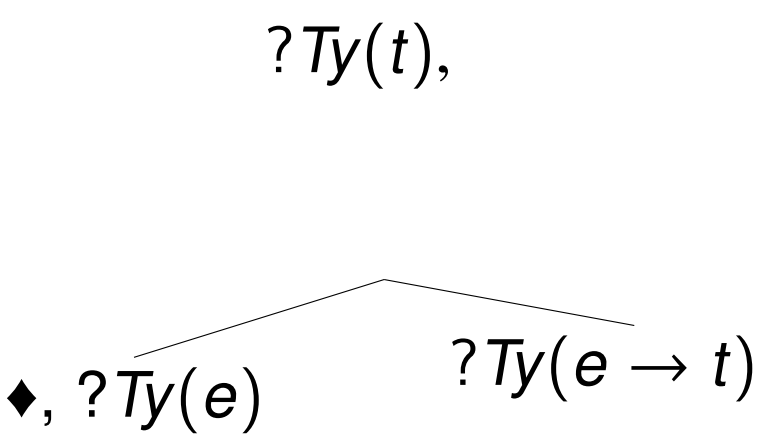
Parsing “John Fainted” with DS-TTR

- Words:

$$?Ty(t), \blacklozenge$$

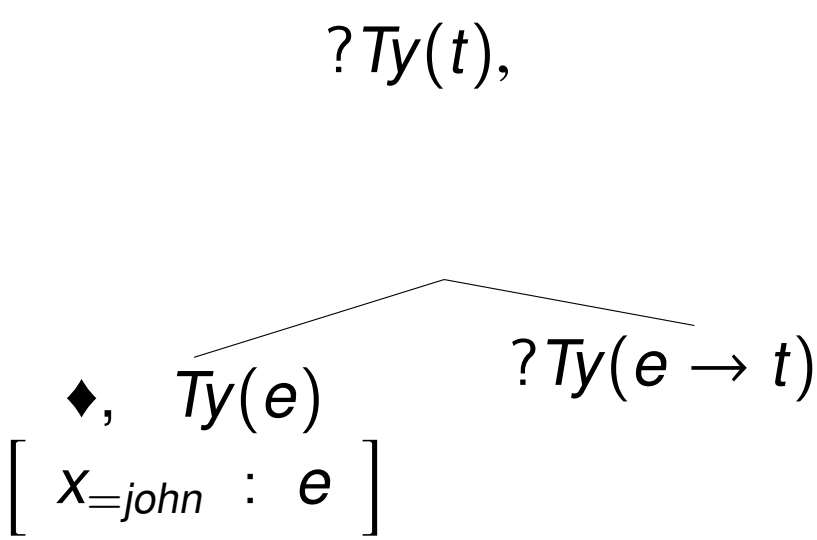
Parsing “John Fainted” with DS-TTR

- Words:



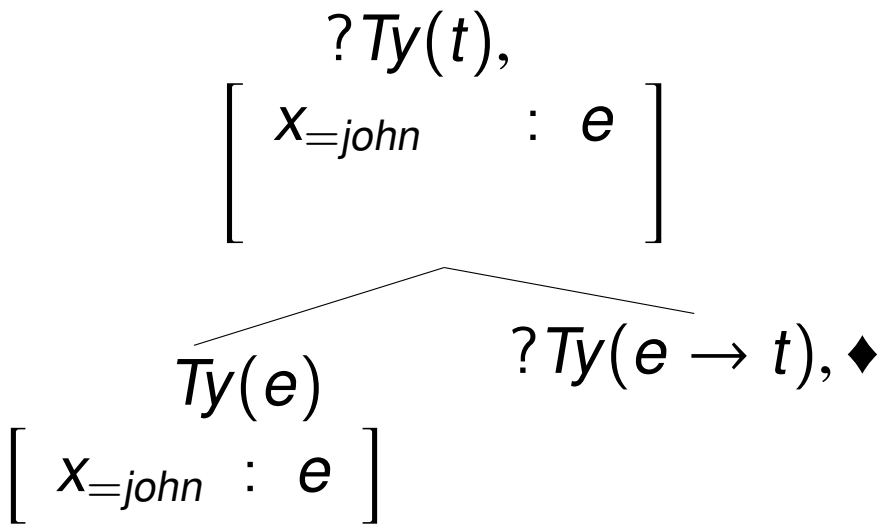
Parsing “John Fainted” with DS-TTR

- Words: John



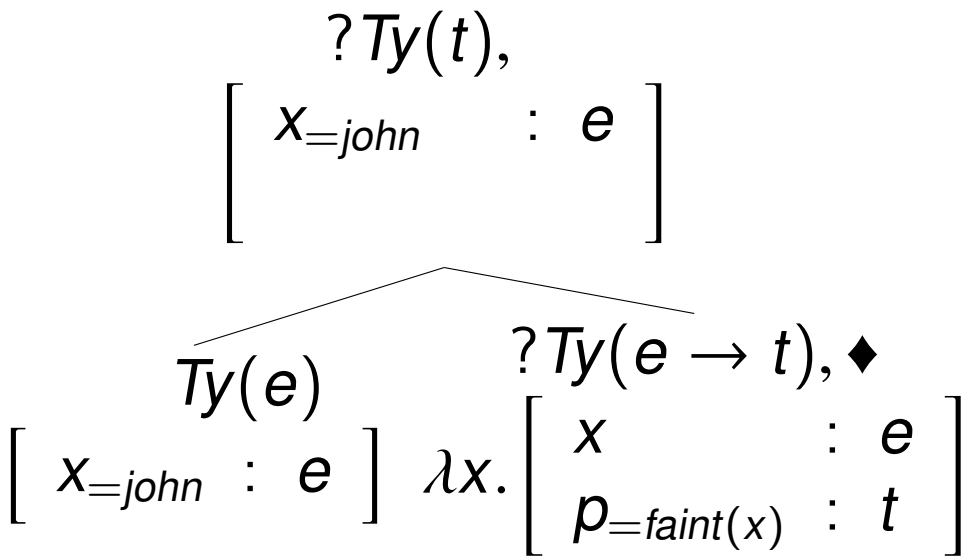
Parsing “John Fainted” with DS-TTR

- Words: John



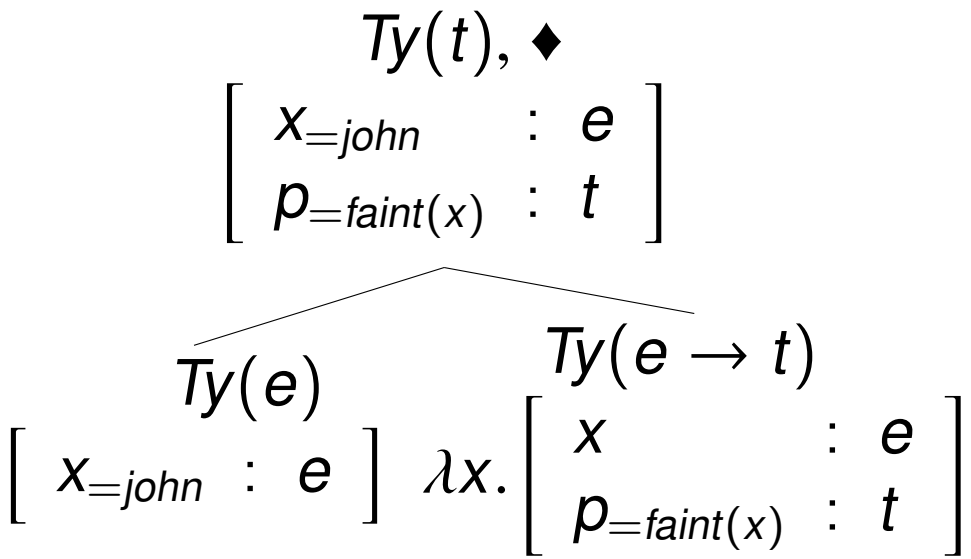
Parsing “John Fainted” with DS-TTR

- Words: John fainted



Parsing “John Fainted” with DS-TTR

- Words: John fainted

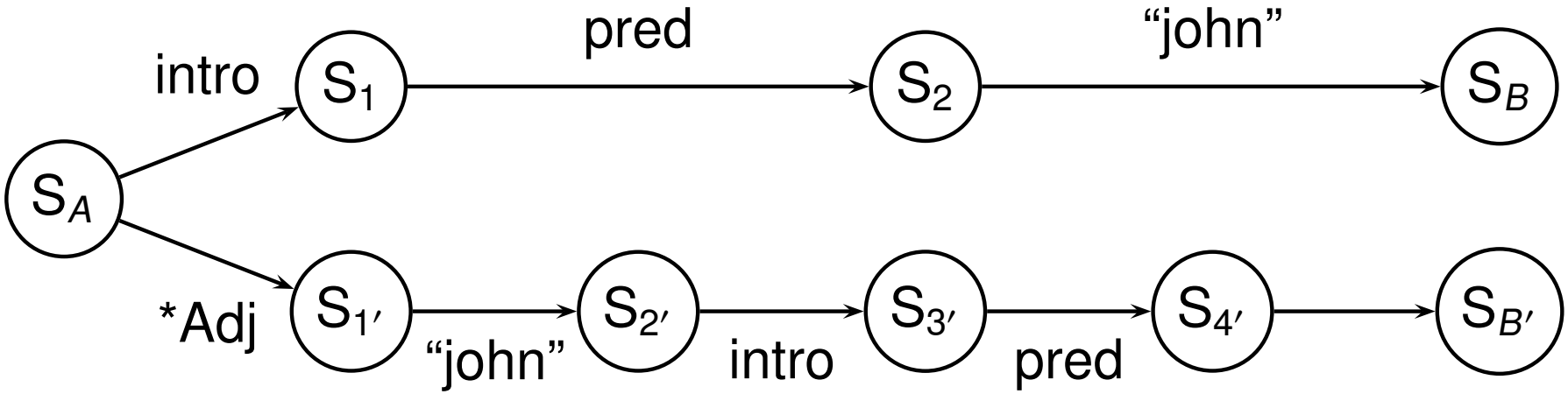


Modelling feedback in DS

- Dynamic Syntax can provide a formal model of where feedback should be licensed. . .

  (Howes and Eshghi, 2017)
- . . . and how it should be integrated (Eshghi et al., 2015)

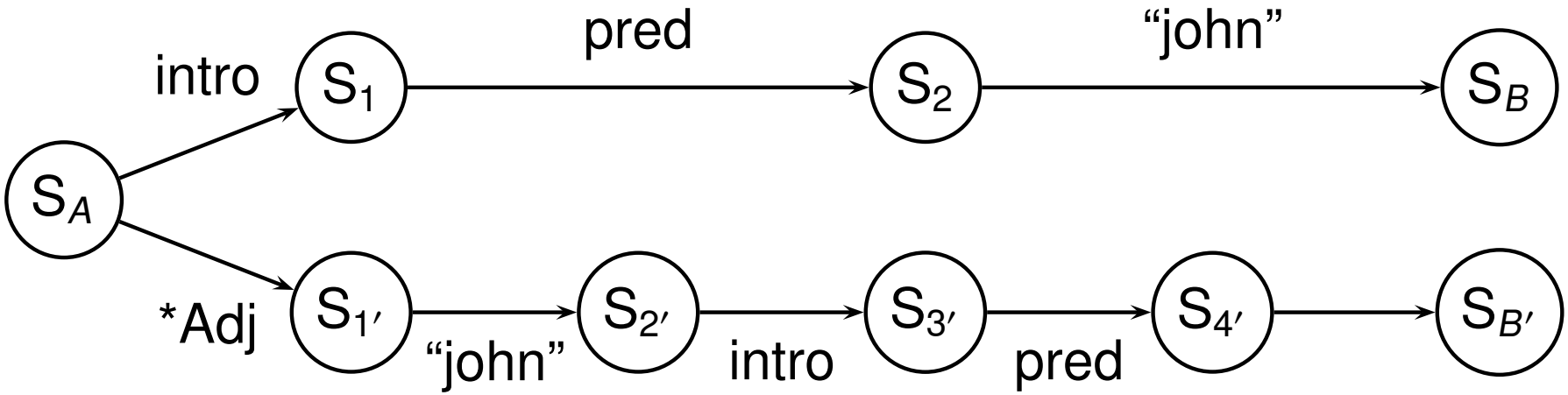
Context in Dynamic Syntax



Nodes = Semantic Trees

Edges = Lexical or Computational actions

Context in Dynamic Syntax



Nodes = Semantic Trees

Edges = Lexical or Computational actions

- Parsing/generation modelled on Directed Asyclic Graph (DAG)
- Parsing = incremental search/construction of this DAG (Sato, 2011)
- Context in DS *is* this DAG(Eshghi et al., 2013; Purver et al., 2011)
- Model of CRs, short answers, self-repair, etc. (Hough and Purver, 2012; Hough, 2015; Kempson et al., 2016, among many others)

The context model as such...

- Enables modelling of contextual updates arising from CRs, short answers, rejections, split utterances, self-repair, and other uses of context dependency. (Hough and Purver, 2012; Hough, 2015; Kempson et al., 2016, among many others)
- . . . purely in terms of processing: No recourse to dialogue acts, intentions, or higher order reasoning (Eshghi et al., 2015; Howes and Eshghi, 2017)

Modelling feedback in DS

- To model grounding states, we augment the context DAG with two *Coordination Pointers*

Modelling feedback in DS

- To model grounding states, we augment the context DAG with two *Coordination Pointers*
  - The *self-pointer*, ♦, and
  - The *other-pointer*, ♢

Modelling feedback in DS

- To model grounding states, we augment the context DAG with two *Coordination Pointers*
  - The *self-pointer*, ♦, and
  - The *other-pointer*, ♢
- The intersection of self-pointer-to-root and other-pointer-to-root path is *grounded*

Modelling feedback in DS

- To model grounding states, we augment the context DAG with two *Coordination Pointers*
  - The *self-pointer*, ♦, and
  - The *other-pointer*, ♢
- The intersection of self-pointer-to-root and other-pointer-to-root path is *grounded*
- Discursive potential (Ginzburg, 2012) or discourse obligations (Matheson et al., 2000) as pointer divergence
- Recently dubbed: **Interaction Control State (ICS)**

Interpreting backchannels

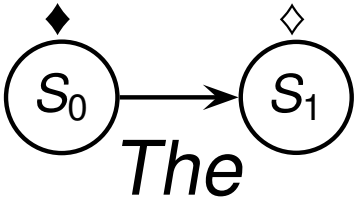
Dialogue

A: The

Context-final semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \end{bmatrix}$$

A's context after dialogue



Interpreting backchannels

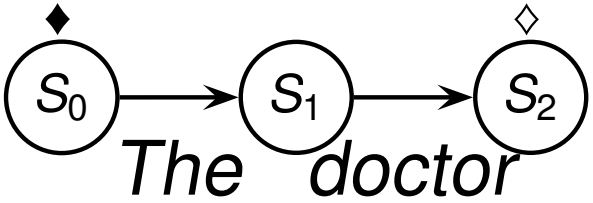
Dialogue

A: The doctor

Context-final semantics

$$\left[\begin{array}{lll} r & : & \left[\begin{array}{lll} x & : & e \\ p_{=doctor(x)} & : & t \end{array}\right] \\ x_{=\iota(r.x,r)} & : & e \end{array}\right]$$

A's context after dialogue



Interpreting backchannels

Dialogue

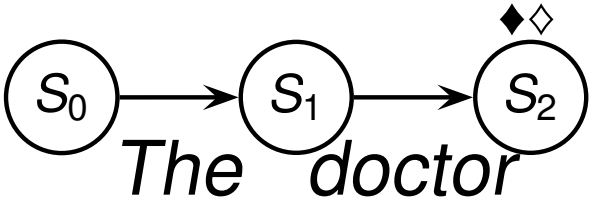
A: The doctor

B: mhm

Context-final semantics

$$\left[\begin{array}{lcl} r & : & \left[\begin{array}{lcl} x & : & e \\ p_{=doctor(x)} & : & t \end{array}\right] \\ x_{=\iota(r.x,r)} & : & e \end{array}\right]$$

A's context after dialogue



Interpreting backchannels

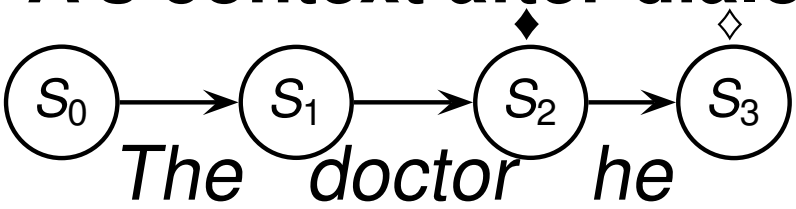
Dialogue

A: The doctor
B: mhm
A: he

Context-final semantics

$$\left[\begin{array}{lcl} r & : & \left[\begin{array}{lcl} x & : & e \\ p_{=doctor(x)} & : & t \end{array}\right] \\ x_{=\iota(r.x,r)} & : & e \end{array}\right]$$

A's context after dialogue



Interpreting backchannels

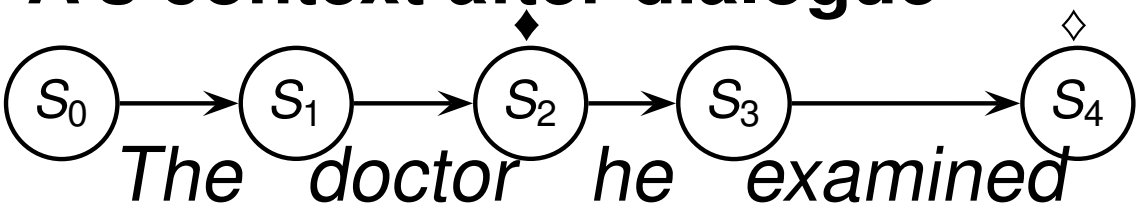
Dialogue

A: The doctor
B: mhm
A: he examined

Context-final semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \end{bmatrix}$$

A's context after dialogue



Interpreting backchannels

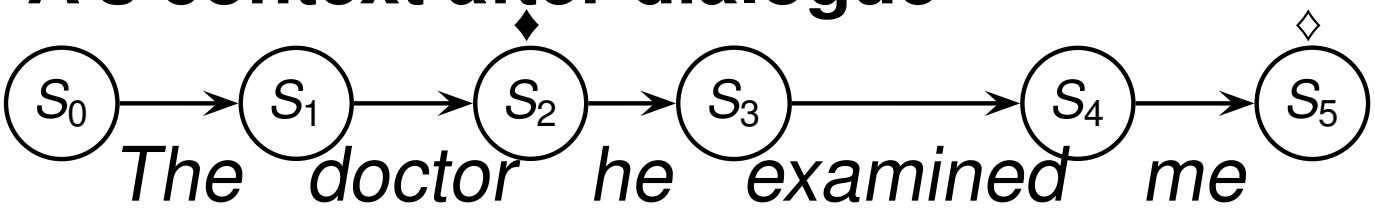
Dialogue

A: The doctor
B: mhm
A: he examined me

Context-final semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \\ x1_{=spkr} & : & e \\ p1_{=obj(ev,x1)} & : & t \end{bmatrix}$$

A's context after dialogue



Interpreting backchannels

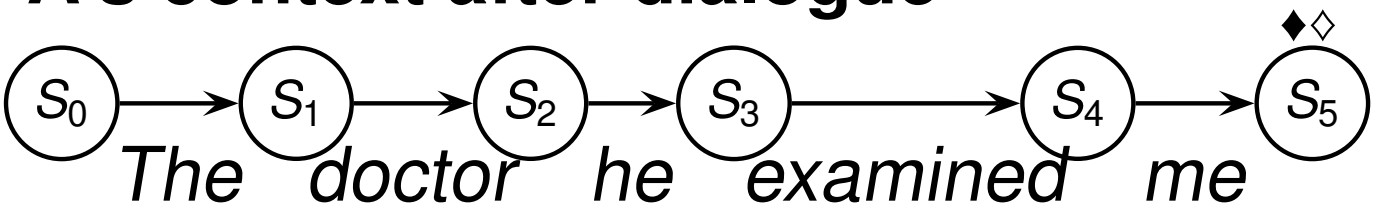
Dialogue

A: The doctor
B: mhm
A: he examined me
B: okay

Context-final semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \\ x1_{=spkr} & : & e \\ p1_{=obj(ev,x1)} & : & t \end{bmatrix}$$

A's context after dialogue



- Repairs (and CRs) lead to branching in graph, see Eshghi et al. (2015)

Licensing Backchannels: placement

Lexical Entry for a backchannel:

mhm	IF	$?Ty(X)$	
	THEN	`abort`	
	ELSE	IF	$\langle\uparrow_0\downarrow_1\rangle\exists x.Tn(x)$
			$\langle\uparrow_0\downarrow_1\rangle\neg\exists x.?x$
			$\neg\exists x.?x$
		THEN	`abort`
		ELSE	`do-nothing`

Precludes "**A:** John arrived with ... **B:** mhm"

- For details see Howes and Eshghi (2017)

Processing Clarification Requests

- Local and non-local CRs
- Extend a semantic tree in context

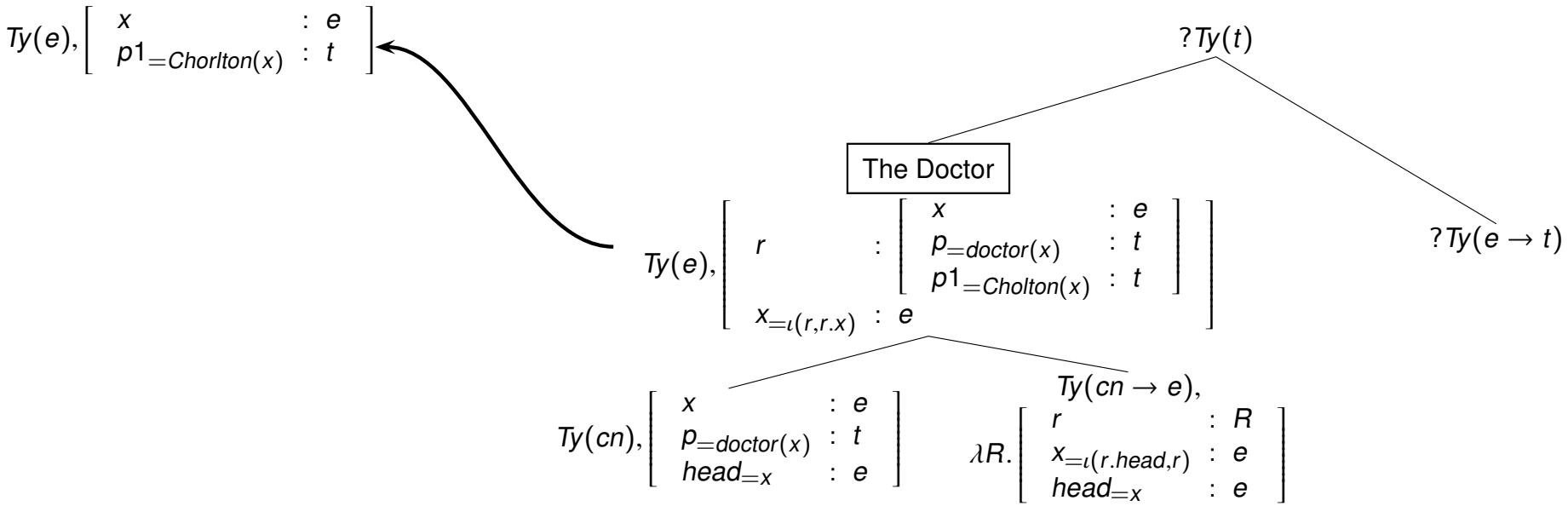
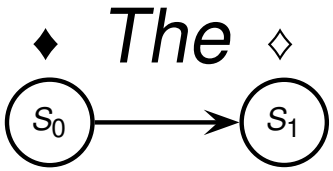


Figure: Processing *Chorlton?* in "A: *the doctor* B: *Chorlton?*"

Clarification Interaction in DS

Dialogue

A: The



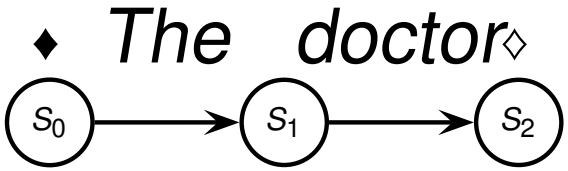
Context-Final Semantics

$$\begin{bmatrix} & & \begin{bmatrix} x & : e \end{bmatrix} \\ r & : & \\ x_{=\iota(r.x,r)} & : e & \end{bmatrix}$$

Clarification Interaction in DS

Dialogue

A: The doctor



Context-Final Semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \end{bmatrix}$$

Clarification Interaction in DS

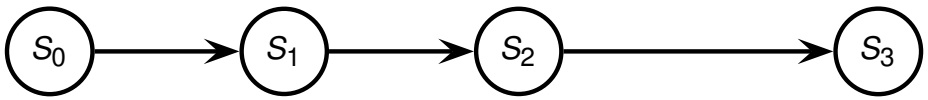
Dialogue

A: The doctor examined

Context-Final Semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \end{bmatrix}$$

♦ *The doctor examined*◊



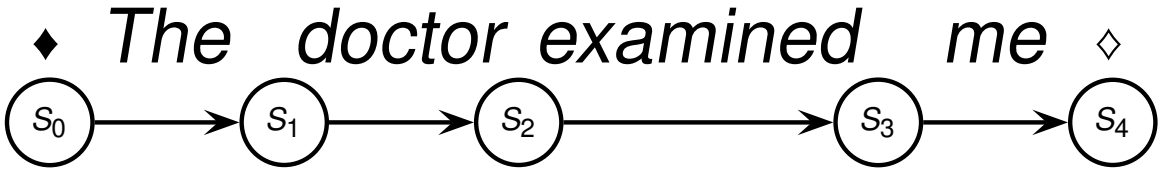
Clarification Interaction in DS

Dialogue

A: The doctor examined me

Context-Final Semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \\ x1_{=spkr} & : & e \\ p1_{=obj(ev,x1)} & : & t \end{bmatrix}$$



Clarification Interaction in DS

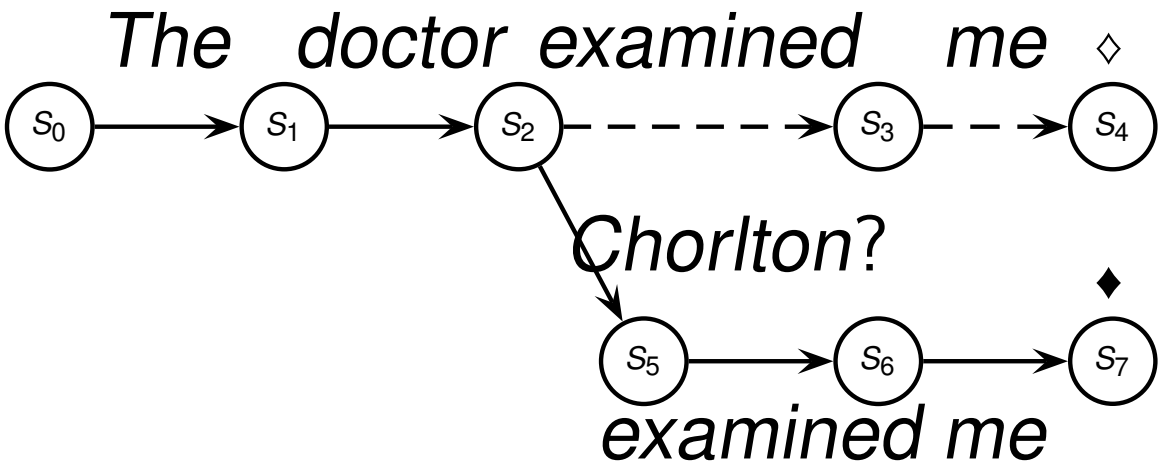
Dialogue

A: The doctor examined me

B: Chorlton?

Context-Final Semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \\ p1_{=Chorl(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \\ x1_{=spkr} & : & e \\ p1_{=obj(ev,x1)} & : & t \end{bmatrix}$$



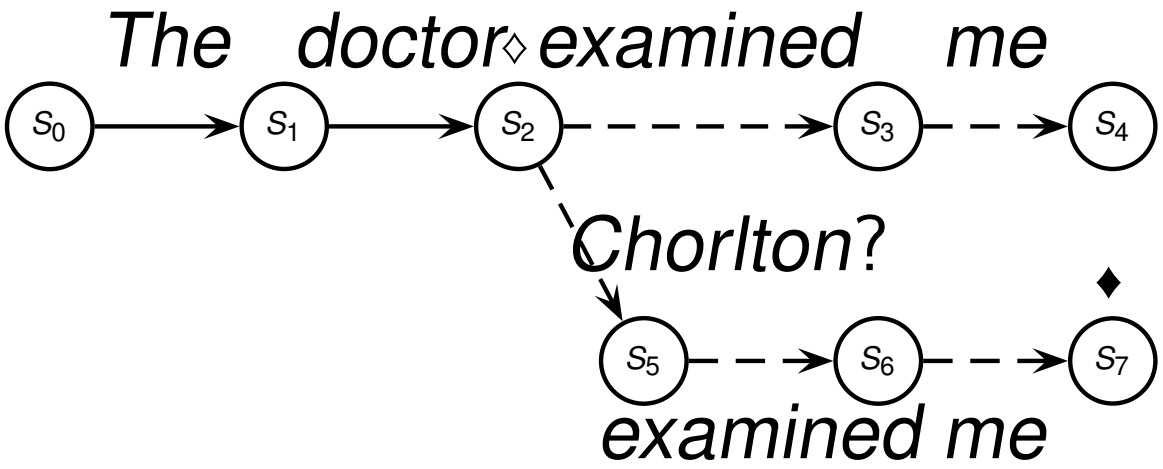
Clarification Interaction in DS

Dialogue

A: The doctor examined me
B: Chorlton?
A: no,

Context-Final Semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \\ p1 & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \\ x1_{=spkr} & : & e \\ p1_{=obj(ev,x1)} & : & t \end{bmatrix}$$



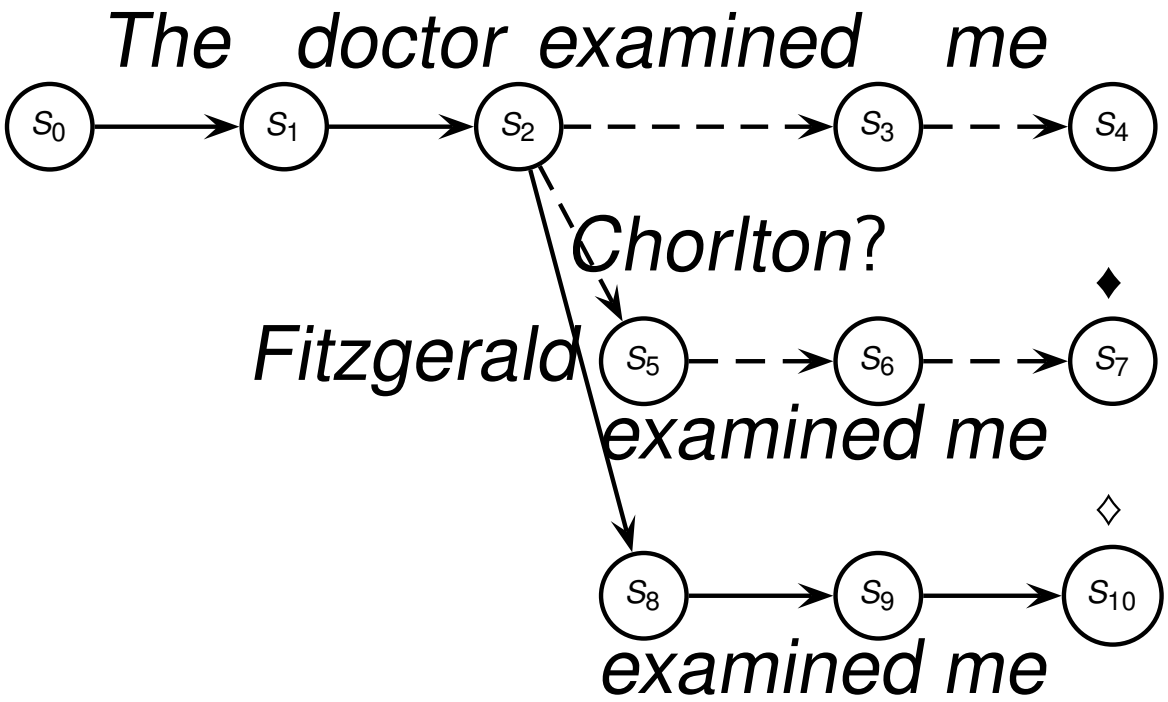
Clarification Interaction in DS

Dialogue

A: The doctor examined me
B: Chorlton?
A: no, Fitzgerald

Context-Final Semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \\ p1_{=Fitz(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \\ x1_{=spkr} & : & e \\ p1_{=obj(ev,x1)} & : & t \end{bmatrix}$$



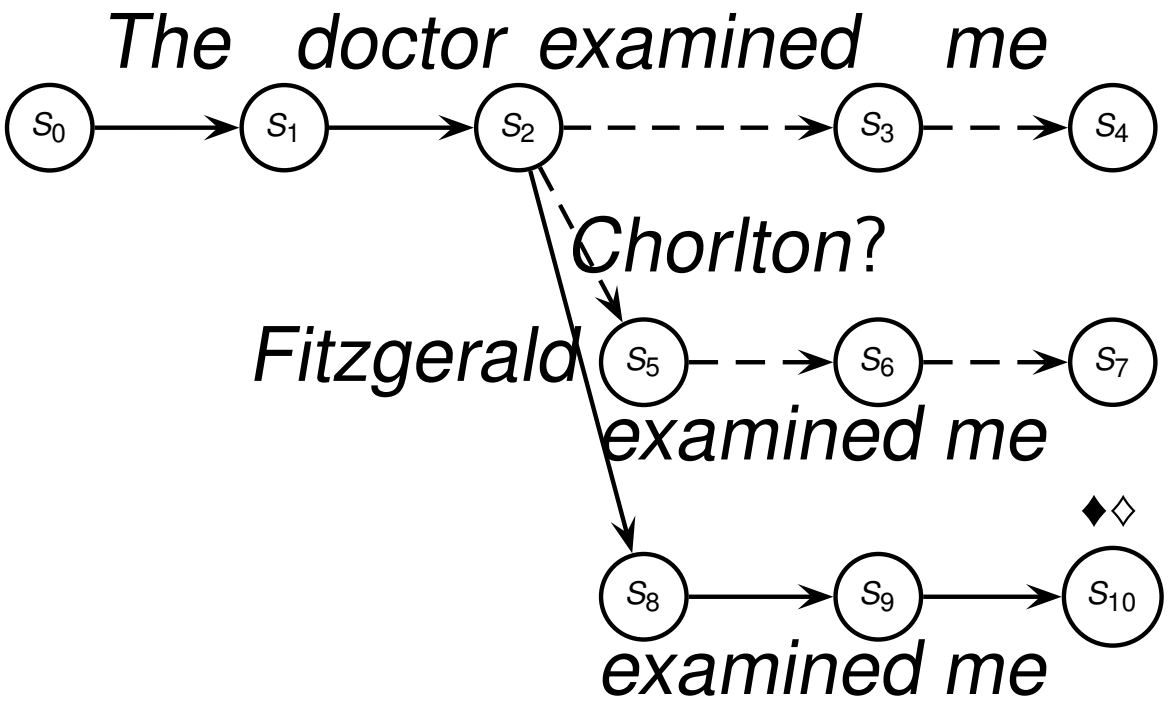
Clarification Interaction in DS

Dialogue

A: The doctor examined me
B: Chorlton?
A: no, Fitzgerald
B: uh-huh

Context-Final Semantics

$$\begin{bmatrix} r & : & \begin{bmatrix} x & : & e \\ p_{=doctor(x)} & : & t \\ p1_{=Fitz(x)} & : & t \end{bmatrix} \\ x_{=\iota(r.x,r)} & : & e \\ ev_{=examine} & : & es \\ p_{=subj(ev,x)} & : & t \\ x1_{=spkr} & : & e \\ p1_{=obj(ev,x1)} & : & t \end{bmatrix}$$



‘Late’ feedback

- the listener may be lagging slightly behind the speaker
- ‘Late’ feedback can be interpreted as grounding the most recent increment

i.e. move *other-pointer* to most recent DAG position at which Completion was possible

- this search is computationally expensive, so should lead to disruption

‘Early’ feedback

- not licensed. . .
- but is expected where the (content) completion is predictable, given the machinery of DS
- Consistent with experimental results (Howes et al., 2012b)
- Early feedback only looks early? i.e. it is parsed/produced after covert prediction of node content for the hearer? - computationally inexpensive

Overview

Discussion

- Model of feedback at FRSs and non-FRSs
- Corpus evidence broadly consistent with model predictions
- Backchannels serve to align processing contexts
- .. and reduce ambiguity/complexity
- Other context-dependent forms align interpretation pathways

→ Context-dependency at the centre of participant coordination and feedback in dialogue

  - clipping alternative interpretation paths

  → pervasiveness not coincidental. . .

  → . . . and not just about least effort

Future directions

- Feedback in multi-party dialogue?
- Results are correlational: need an experimental study
- . . . including non-verbal feedback
- incorporate fully into DS implementation & working dialogue system

Thanks!

Questions... especially comments please!

References I

Bavelas, J. B., Coates, L., Johnson, T., et al. (2000). Listeners as co-narrators. Journal of personality and social psychology, 79(6):941–952.

Cann, R., Kempson, R., and Marten, L. (2005). The Dynamics of Language. Elsevier, Oxford.

Clark, H. H. (1996). Using Language. Cambridge Univ Press.

Cooper, R. (2012). Type theory and semantics in flux. In Kempson, R., Asher, N., and Fernando, T., editors, Handbook of the Philosophy of Science, volume 14: Philosophy of Linguistics, pages 271–323. North Holland.

Duncan, S. (1972). Some signals and rules for taking speaking turns in conversations. Journal of Personality and Social Psychology, 23(2):283 – 292.

Eshghi, A., Howes, C., Gregoromichelaki, E., Hough, J., and Purver, M. (2015). Feedback in conversation as incremental semantic update. In Proceedings of the 11th International Conference on Computational Semantics (IWCS), London, UK. ACL.

Eshghi, A., Purver, M., and Hough, J. (2013). Probabilistic induction for an incremental semantic grammar. In Proceedings of the 10th International Conference on Computational Semantics (IWCS 2013) – Long Papers, pages 107–118, Potsdam, Germany. Association for Computational Linguistics.

Ginzburg, J. (2012). The Interactive Stance: Meaning for Conversation. Oxford University Press.

References II

Goodwin, C. (1981). Conversational organization: Interaction between speakers and hearers. Academic Press, New York.

Healey, P. G. T., Eshghi, A., Howes, C., and Purver, M. (2011). Making a contribution: Processing clarification requests in dialogue. In Proceedings of the 21st Annual Meeting of the Society for Text and Discourse, Poitiers.

Healey, P. G. T., Mills, G., Eshghi, A., and Howes, C. (2018). Running Repairs: Coordinating Meaning in Dialogue. Topics in Cognitive Science, 10(2):367–388.

Heldner, M., Hjalmarsson, A., and Edlund, J. (2013). Backchannel relevance spaces. In Nordic Prosody: Proceedings of XIth Conference, Tartu 2012, pages 137–146.

Hough, J. (2015). Modelling Incremental Self-Repair Processing in Dialogue. PhD thesis, Queen Mary University of London.

Hough, J. and Purver, M. (2012). Processing self-repairs in an incremental type-theoretic dialogue system. In Proceedings of the 16th SemDial Workshop on the Semantics and Pragmatics of Dialogue (SeineDial), pages 136–144, Paris, France.

Howes, C. and Eshghi, A. (2017). Feedback relevance spaces: The organisation of increments in conversation. In Proceedings of the 12th International Conference on Computational Semantics (IWCS 2017). Association for Computational Linguisitics.

References III

Howes, C., Healey, P. G. T., and Purver, M. (2012a). Whose turn is it anyway? same- and cross-person compound contributions in dialogue. In Proceedings of the 34th Annual Meeting of the Cognitive Science Society (CogSci 2012), pages 1697–1702, Sapporo, Japan.

Howes, C., Healey, P. G. T., Purver, M., and Eshghi, A. (2012b). Finishing each other's ... responding to incomplete contributions in dialogue. In Proceedings of the 34th Annual Meeting of the Cognitive Science Society (CogSci 2012), pages 479–484.

Kawahara, T., Yamaguchi, T., Inoue, K., Takanashi, K., and Ward, N. (2016). Prediction and generation of backchannel form for attentive listening systems. In Proc. INTERSPEECH, volume 2016.

Kempson, R., Cann, R., Gregoromichelaki, E., and Chatzikiriakidis, S. (2016). Language as mechanisms for interaction. Theoretical Linguistics, 42(3-4):203–275.

Kempson, R., Meyer-Viol, W., and Gabbay, D. (2001). Dynamic Syntax: The Flow of Language Understanding. Blackwell.

Kjellmer, G. (2009). Where do we backchannel? On the use of mm, mhm, uh huh and such like. International journal of corpus linguistics, 14(1):81–112.

Park, H. W., Gelsomini, M., Lee, J. J., and Breazeal, C. (2017). Telling stories to robots: The effect of backchanneling on a childs storytelling. In Proceedings of the ACM/IEEE International Conference on Human-Robot Interaction, pages 100–108. ACM.

References IV

Poppe, R., Truong, K. P., and Heylen, D. (2011). Backchannels: Quantity, type and timing matters. In International Workshop on Intelligent Virtual Agents, pages 228–239. Springer.

Purver, M., Eshghi, A., and Hough, J. (2011). Incremental semantic construction in a dialogue system. In Bos, J. and Pulman, S., editors, Proceedings of the 9th International Conference on Computational Semantics, pages 365–369, Oxford, UK.

Purver, M., Howes, C., Gregoromichelaki, E., and Healey, P. G. T. (2009). Split utterances in dialogue: A corpus study. In Proceedings of the 10th Annual SIGDIAL Meeting, pages 262–271, London, UK. Association for Computational Linguistics.

Sacks, H., Schegloff, E., and Jefferson, G. (1974). A simplest systematics for the organization of turn-taking for conversation. Language, 50(4):696–735.

Sato, Y. (2011). Local ambiguity, search strategies and parsing in Dynamic Syntax. In Gregoromichelaki, E., Kempson, R., and Howes, C., editors, The Dynamics of Lexical Interfaces. CSLI Publications.

Schegloff, E. A. (1982). Discourse as an interactional achievement: Some uses of uh huhand other things that come between sentences. Analyzing discourse: Text and talk, 71:93.