Natural Language Processing

Lecture 19

Today's Outline

Announcements (exams, Friday ISP seminar)

Help Design a Conversational Agent!

- http://www.cs.cmu.edu/~sshriver/exp/kwds2/newkwds1.htm

Homework 3

Review

- reference resolution
- text coherence

Finish Discourse Analysis

- discourse structure

Dialogue and Conversational Agents

Review: Reference Resolution

John went to Bill's car dealership to check out <u>an Acura Integra</u>. *He* looked at <u>it</u> for about half an hour.

Pronoun Resolution Algorithms

- discourse model update
- Lappin and Leass
- BFP centering

Review: Text Coherence

Coherent vs. incoherent texts

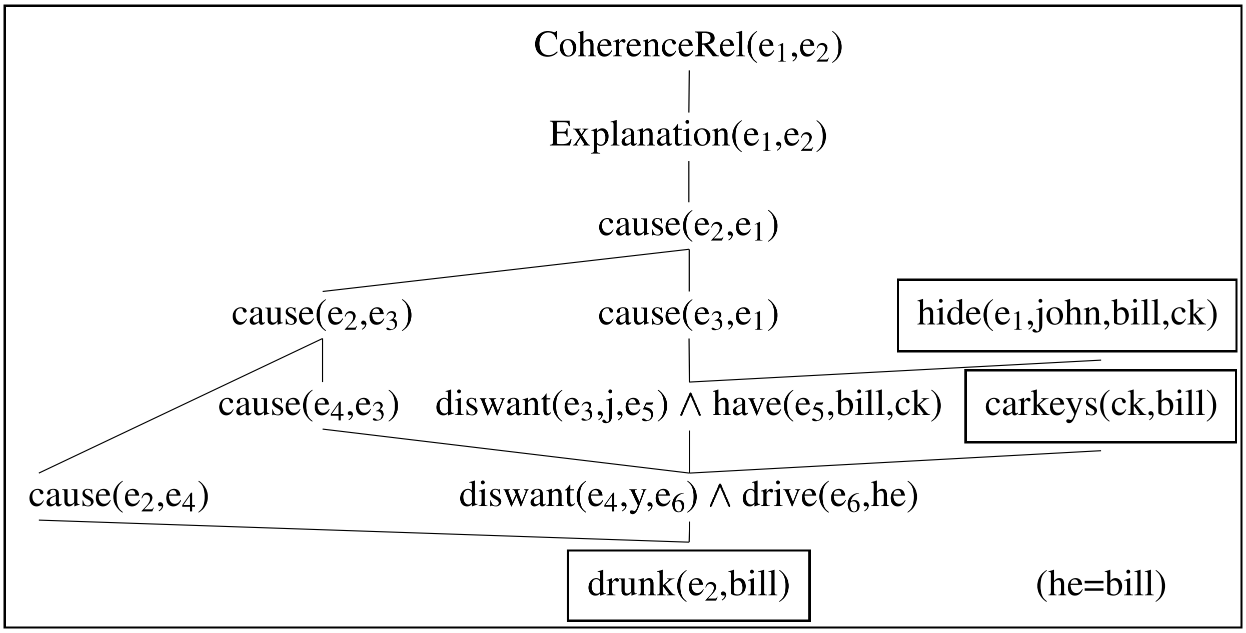
- John hid Bill's car keys. He was drunk
- ? John hid Bill's car keys. He likes spinach.

Examples of Coherence Relations from Hobbs

- Result
  - Infer that the state or event asserted by the meaning of the first sentence (S_0) causes or could cause the state or event asserted by the meaning of the second sentence (S_1).
  - John bought an Acura. His father went ballistic.
  - *and*
- Explanation
  - Infer that the state or event asserted by S_1 causes or could cause the state or event asserted by S_0.
  - John hid Bill's car keys. He was drunk.
  - *because*

Review: An Abductive Algorithm

John hid Bill's car keys. He was drunk.



The coherence derivation causes the inference of implicit information, reference resolution.

Dialogue and Conversational Agents

"**Conversation** or **dialogue** is the most fundamental and specially privileged arena of language."

What makes dialogue different?

- turn-taking
- grounding
- implicature

Speech act representation and interpretation.

New approaches to coherence and structure.

Turns and Utterances

Dialogue is characterized by turn-taking.

C_1:	...I need to travel in May.
A_1:	And, what day in May did you want to travel?
C_2:	OK uh I need to be there for a meeting that's from the 12th to the 15th.
A_2:	And you're flying into what city?
C_3:	Seattle.
A_3:	And what time would you like to leave Pittsburgh?
C_4:	Uh hmm I don't think there's many options for non-stop.
A_4:	Right. There's three non-stops today.
C_5:	What are they?
A_5:	The first one departs PGH at 10:00am arrives Seattle at 12:05 their time. The second flight departs PGH at 5:55pm, arrives Seattle at 8pm. And the last flight departs PGH at 8:15pm arrives Seattle at 10:28pm.
C_6:	OK I'll take the 5ish flight on the night before on the 11th.
A_6:	On the 11th? OK. Departing at 5:55pm arrives Seattle at 8pm, U.S. Air flight 115.
C_7:	OK.

Speakers know how to take turns (*who* should talk next, and *when* they should talk)

- little overlap (around 5% in English - although depends on the domain!)
- not much silence between turns either

Turns

Conversation Analysis provides a socio-linguistic approach to turn-taking (e.g., Sacks et al.).

Turn-Taking Rule (simplified):

At each <u>transition-relevance place</u> of each turn:

- If during this turn current speaker has selected A as the next speaker, then A must speak next.
- If current speaker does not select the next speaker, any other speaker may take the next turn.
- If no one else takes the next turn, the current speaker may take the next turn.

Transition-relevance places are where the structure of the language allows speaker shifts to occur.

Conversation Analysis (cont.)

Adjacency pairs (set up next speaker expectations)

- GREETING GREETING
- QUESTION ANSWER
- COMPLIMENT DOWNPLAYER
- REQUEST GRANT

Significant silence (follows first part of an adjacency pair)

- A: Is there something bothering you or not?
- (1.0)
- A: Yes or no?
- (1.5)
- A: Eh?
- B: No.

Implications for spoken dialogue systems

Utterances

Transition-relevance places are typically at <u>utterance</u> boundaries.

Recall that (spoken) utterances are typically shorter, contain more pronouns, have repairs . . . , compared to written sentences.

Many theories take the utterance as the primitive unit, but utterances are difficult to segment

- a single utterance may occur across several turns
  - A: We've got you on USAir flight 99
  - B: Yep
  - A: leaving on December 1.
- multiple utterances may occur in a single turn
  - A: We've got you on USAir flight 99 leaving on December 1. Do you need a rental car?
- linguistic boundary cues include cue words, ngrams, prosody

Grounding

Conversational participants must constantly establish common ground (or mutual belief).

Thus, a hearer must ground a speaker's utterances (by making it clear that (believed) understanding has occurred), or else indicate that a grounding problem occurred.

Acknowledgement

- continuer / backchannel / acknowledgement token (also nods if vision available)
- Example
  - A: . . . returning on U.S. flight one.
  - C: *Mm hmm*
- grounds A's utterance, and also returns turn

Display (stronger method)

- display all or part of utterance to be grounded verbatim
- Example
  - C: OK I'll take the 5ish flight on the 11th.
  - A: *On the 11th?*

Request for repair

- indicate lack of grounding
- Example
  - C: OK I'll take the 5ish flight on the 11th.
  - A: *Huh?*
  - C: I'll take the 5ish flight on the 11th.

Conversational Implicature

Pragmatics: the study of how language is used to accomplish goals (Chapter 1); beyond literal meaning.

Conversational Implicature means a particular class of licensed inferences (that the speaker expects the hearer to draw).

Grice's maxims for conversation explain how hearers draw such inferences.

Example

- A: What day in May did you want to travel?
- C: I need to be there for a meeting that's from the 12th to the 15th.
- A: OK. There are 3 non-stops on the 11th.

Implicature-licensed inferences

- the meeting information answers the request for travel dates
- there are not 4 non-stops

Grice's Maxims

Maxim of Quantity: Be exactly as informative as is required:

- Make your contribution as informative as is required (for the current purposes of the exchange).
- Do not make your contribution more informative than is required.

Maxim of Quality: Try to make your contribution one that is true:

- Do not say what you believe to be false.
- Do not say that for which you lack adequate evidence.

Maxim of Relevance: Be relevant:

Maxim of Manner: Be perspicuous:

- Avoid obscurity of expression.
- Avoid ambiguity.
- Be brief (avoid unnecessary prolixity).
- Be orderly.

Which maxims license previous inferences?

Dialogue Acts

Austin (1962) observed that dialogue utterances are a kind of speaker *action*, or speech act.

Example: performative sentences

- I name this ship the Titanic.
- I second this motion.
- I bet you five dollars it will snow tomorrow.

Speech Acts

The utterance of any sentence in a real situation constitutes three kinds of act.

Locutionary acts

- the utterance of a sentence with a particular meaning

Illocutionary acts

- the act of asking, answering, promising, etc. in uttering a sentence

Perlocutionary acts

- the (often intentional) production of certain effects upon the feelings, thoughts, or actions of the addressee in uttering a sentence

You can't do that.

- locutionary: utterance
- illocutionary force: protesting
- perlocutionary effect: stopping or annoying the hearer

Speech Acts

Searle uses this term to classify illocutionary acts (1975).

- Assertives: committing the speaker to something's being the case (*suggesting, putting forward, swearing boasting, concluding*)
- Directives: attempts by the speaker to get the addressee to do something (*asking, ordering requesting, inviting advising, begging*)
- Commissives: committing the speaker to some future course of action (*promising, planning, vowing, betting, opposing*)
- Expressives: expressing the psychological state of the speaker about a state of affairs (*thanking, apologizing, welcoming, deploring*)
- Declarations: bringing about a different state of the world via the utterance (including many of the performative acts above: *I resign, you're fired*)

For Next Time

Finish Chapter 19

Acknowledgements

Some of this material was taken from the course web pages of Drago Radev.