Einführung in Pragmatik und Diskurs

Grounding in Conversation

Ivana Kruijff-Korbayová
korbay@coli.uni-sb.de
http://www.coli.uni-saarland.de/courses/pd/

Summer Semester 2005

Conversation is a Joint Activity

(1)
1. Gracie: Oh yeah . . . and then Mr. and Mrs. Jones were having matrimonial trouble, and my brother was hired to watch Mrs. Jones.
2. George: Well, I imagine she was a very attractive woman.
3. Gracie: She was, and my brother watched her day and night for six months.
4. George: Well, what happened?
5. Gracie: She finally got a divorce.
6. George: Mrs. Jones?
7. Gracie: No, my brother's wife.

(George Burns and Gracie Allen in *The Salesgirl*)
[Jurafsky and Martin2000][Chapter 18]

Outline

- Common ground in conversation
- Establishing common ground
- Patterns of contributions and achieving grounding in conversation
- Multidimensional analysis of communicative acts in dialogue

Reading: [Clark1996][Chapters 4 and 8], [Jurafsky and Martin2000][Chapter 19]

Grounding

- Successful communication requires some degree of *common ground* between the participants
- Two people's common ground (CG) is the sum of their *mutual knowledge* = *common/mutual/joint/shared knowledge knowledge or information*, etc.
- Grounding is the process of augmenting the common ground
- Participants in conversation try to ground what they do together, i.e., to *establish things as common ground well enough for current purposes*
- People take a proposition to be common ground in a community only when they believe they have a proper shared basis for the proposition in that community.

Basic CG Representation

CG-Shared: p is CG for members of community C iff:

1. every member of C has information that basis b holds
2. b indicates to every member of C that every member of C has information that b holds
3. b indicates to members of C that p

Example: It is common ground between agents A and B that there is a conch shell between them on the beach(p), due to shared basis b:

1. A and B have information that situation s holds; s includes beautiful day, beach, sea, A, B, conch shell near A and B
2. b indicates to A and B that both A and B have information that s holds
3. b indicates to both A and B that there is a conch shell between them

Where do shared bases for CG come from?

In coordinating joint actions, agents make use of two broad types of shared bases:

- **Communal CG**: evidence about the cultural communities agents belong to (and the corresponding expertise shared by members of a community).
  CG based on membership in cultural communities includes facts, beliefs, and assumptions about objects, norms of behavior, conventions, procedures, skills, and even inffable experiences. E.g., speakers of one language, citizens of one country, inhabitants of one city, people having one hobby, students of one school or university, etc.

- **Personal CG**: evidence from agents' direct personal experience with each other (= joint personal experiences and actions). It contains "memories" of things done and seen together. Conversation is an example of joint activity. Personal CG contains "memories" of what was discussed, agreed on, argued about, etc.

Individual CG-Shared Representations

- Only an omniscient being can have the "full" CG-shared representation (The Byzantine generals problem: actual mutual knowledge cannot be achieved in situations in which communication is fallible.)

- Individual agents act on their individual beliefs or asumptions about what their common ground is

- Shared bases differ in quality of evidence, i.e., how much they justify each piece of common ground

- Agents may have conflicting information about what is CG between them

- Agents are deceivable

The Historical Origin of CG-Shared

- David Lewis (1969): one of the first formalizations of CG; showed how CG-shared leads to higher-order beliefs of CG-iterated.

- Robert Stalnaker (1973, 1974, 1978): speaker presupposition
  similar mutual knowledge (Lewis 1969) and common knowledge (Shiffer 1972)

- Paul Grice (1975): propositions having common ground status in conversation

Speaker Presupposition (Stalnaker 1978)

- the propositions whose truth the speaker takes for granted as part of the background of the conversation
- speaker presuppositions constitute the common ground in the conversation
- a speaker may presuppose any proposition he finds convenient to assume for the purpose of the conversation, provided he is prepared to assume that his audience will assume it along with him
- a fundamental way of representing speaker's presuppositions is a set of possible worlds compatible with what is presupposed, called **context set**
- to engage in conversation is to distinguish among alternative possibilities

- each participant in a conversation has his own context set
- discrepancies between context sets may lead to failures in communication
- a context is close enough to being nondefective if the divergencies do not affect the conversation issues
- conversation is a process taking place in an ever-changing context
- a state of a context at any given moment is defined by the presuppositions of the participants as represented by their context sets
- assertions change the context:
  - the speaker speaks, saying the words he is saying in a way he is saying them
  - the content of an assertion reduces the context by elimination

Building Up and Exploiting CG

The principle of justification [Clark1996]

> In practice, people take a proposition to be common ground in a community only when they believe they have a proper shared basis for the proposition in that community.

⇒ People should work hard to establish shared bases for their common ground, and that should affect how they proceed in language use.

- finding evidence of shared bases in signals that agents display
- linking new pieces of CG to old ones
- systematic methods for correcting defective pieces of CG
- using CG to succeed in completing joint activities: grounding

Joint Closure in Conversation

Principle of joint closure: Agents try to establish shared basis for the mutual belief that they have succeeded well enough for the current purposes.

⇒ contributors require *positive evidence* that their partners understood.
(Contrast this with the assumption of understanding unless *negative evidence* to the contrary is presented, e.g., [Grosz and Sidner1986])

Types of Positive Evidence:

- Assertions of understanding, e.g., acknowledgements (= nod or "continuer" e.g., *uh-huh, yeah, right*; or assessment, e.g., *that's great*)
- Exemplifications of understanding (e.g., repetition, paraphrase or completion)
- Displays of understading as part of joint project uptake
- Presuppositions of understanding (e.g., joint project uptake or relevant next turn initiation)

Contribution(s)

Contribution to Conversation

Contribution to conversation: a signal successfully understood (= joint action)

- **Presentation phase**: A presents a signal for B to understand. He assumes that, if B gives evidence e or stronger, he can believe that B understands what he means by it.
- **Acceptance phase**: B accepts A's signal by giving evidence e' that she believes she understands what A means by it. She assumes that, once A registers e', he too will believe she understands.

Concluded Contributions

A presents a signal that B accepts by presupposing understanding = by inititating the next contribution at the same level as A's contribution. (p. 229)

(2) 1. A: Can I speak to Jim Johnston senior please?
    2. B: I am connecting you.

(3) 1. A: Can I speak to Jim Johnston senior please?
    2. B′: Sorry, he is out for lunch.

(cf. the notion of adjacency pair in conversational analysis)

Continuing Contributions

A presents a signal that B accepts by asserting understanding with a backgrounded acknowledgement token (= continuer / backchannel), e.g., "mmm-mm", "I see", "uh-h", but also (unison) completion

- Immediate reaction
- Overlapping speech
- Backgrounding
- B does not take the turn (p. 230-231)

(4) A: Can I speak to Jim Johnston senior please?
    B: Yes- Yes. I am connecting you.

Other Patterns of Contributions

Typically, contributions with problems of Joint Closure,
i.e., not completed or continuing

- Acceptance phase often gets expanded when B has trouble understanding A's presentation ⇒ grounding subdialog, e.g., clarification, repair
- Presentation phase often gets expanded when A anticipates B will have trouble understanding ⇒ dividing up and/or possibly requesting feedback through grounding subdialog, e.g., confirmation, verification

Levels of Understanding

Establishing CG *well enough for current purposes* at *all levels of communication* according to the joint action ladder:

A's actions	B's actions
proposing joint project w	considering proposal of w
signaling that p	recognizing that p
presenting signal s	identifying signal s
executing behaviour t	attending to behavior t

- upward completion and downward evidence
- general principles about discharging intentions

Grounding States

(derived from the joint action ladder levels)

State 4 B is considering taking up A's proposed joint project

State 3 B understood what A meant (but isn't in state 4)

State 2 B identified A's presentation correctly (but isn't in state 3)

State 1 B noticed that A has executed a presentation (but isn't in state 2)

State 0 B noticed that A has executed some communicative behavior

Expanded Acceptance Phase

Expanded Acceptance Phase

If B isn't in state 3, according to the joint closure principle, she should initiate a (repair) process that will bring her to state 3.

(5)
1. A: Can I speak to Jim Johnston please?
2. (pause)
3. A: Can I speak to Jim Johnston please?
4. B: Yes, I am connecting you.

(6)
1. A: Can I speak to Jim Johnston please?
2. B: eh?
3. A: Can I speak to Jim Johnston please?
4. B: Yes, I am connecting you.

Expanded Acceptance Phase

B is often in a mixed state for different parts of A's presentation

(7)
1. A: Can I speak to Jim Johnston please?
2. B: Jim who?
3. A: Jim Johnston.
4. B: And what about him?
5. A: Can I speak to him please?
6. B: Oh, yes, I am connecting you.

(8)
1. A: Can I speak to Jim Johnston please?
2. B: Senior?
3. A: Yes.
4. B: OK, I am connecting you.

Local conversation organization: Repair Sequences

Repair Sequences

Some terminology:

self-repair: repair done by speaker of repairable item

other-repair: repair done by other party

self-initiated repair: repair by speaker without prompting

other-initiated repair: repair done by speaker after prompting from other party

Schegloff, Jefferson and Sacks 1977 propose a device for the correction of misunderstandings, mishearings and non-hearings which consists of two parts:

Preference organization of repairs

- Slots in which repair or repair-prompting can be done
  - T1 (includes repairable item): Opportunity 1 for self-initiated repair.
  - Transition space T1/T2: Opportunity 2 for self-initiated repair.
  - T2: Opportunity 3 either for other-repair or for other-initiation of self-repair in T3.
  - T3: Opportunity 4 given other-initiation in T2 for other-initiated self-repair.
- Preferences across the opportunity set given above:
  1. self-initiated self-repair in Opportunity 1 (T1).
  2. self-initiated self-repair in Opportunity 2 (T1/T2).
  3. other-initiation in Opportunity 3 or self-repair in T3.
  4. other-initiated other-repair in Opportunity 3 (T2).

Preference organization of repairs

Self-initiated self-repair in Opportunity 1 or 2:

(9) A: She was giving me all the people ehm **students** that were gone this year I mean this **quarter** you know.

Other-initiated self-repair in Opportunity 3:

(10) A. .hhh Well I'm working through the Amfat Corporation.
B. The who?
A. **Amfah Corporation**. T's a holding company.

Other-initiated other-repair in Opportunity 4:

(11) A. Lissena pigeons.
B. **Quail** I think.

Preference organization of repairs

These preferences correspond to what is observed in practice:

- There is a tendency for self-initiated self-repair (Pref 1 and 2)
- A delay in T2 indicates a problem and thereby invites self-initiated self-repair (Pref 2)
- Even when the other party can do the repair, she prefers to initiate self-repair over doing other-repair (Pref 3)
- Other repairs are often accompanied by moderators e.g. "I think", (Pref 4)

In general,

(i) self-initiated repairs are preferred over other-initiated repairs and

(ii) self-repairs are preferred over other-repairs.

Expanded Presentation Phase

Expanded Presentation Phase: Installments

(p. 235–237)

(12)
1. A: I need a flight with Delta Airlines.
2. B: Uh-h.
3. A: Departing from Boston.
4. B: mm-
5. A: Going to Seattle.
6. B: OK.
7. A: How much will business class be?

(13) I need a business class flight with Delta Airlines from Boston to Seattle.

Expanded Presentation Phase: Trials and Probes

Trial constituents (with try markers): material presented in a way that ellicits grounding feedback (confirmation or correction) in the middle of a presentation. (p. 240)

(14)
1. A: I need a flight with Delta Airlines–
2. B: Uh-h.
3. A: From Boston–?
4. B: mm-
5. A: To Seattle–?
6. B: OK.

Communicative Probes: communicative actions carried out with the expectation that they may fail (on any of the four levels); the failure may be as informative as the success would be. (p. 235)

Packaging of Installments

What is the optimal size of a contribution?

- The smaller the chunks with grounding feedback, the longer communication takes
- The larger the chunks, the more danger of snowball effect of a misunderstanding at some point
- Working memory constraints

⇒ Variable size, depending on skills and purposes.

- Collaborative completions: other partner completes
- Truncations and fade-outs: presenter stops

(p. 239–240)

Embedded Contributions

Hierarchical Structure of Contributiuons:

In the contribution model every signal is part of a presentation phase of a projected contribution. This holds also for a repair initiation, and even for any acceptance phase.

And, all acceptance phases must end with positive evidence, with concluded or continuing contributions. If they didn't, they would go on for ever.

When Does Overlapping Speech Occur?

Three basic cases of speech overlaps:

- Backchannel feedback: background aknowledgement in a continuing presentation of a contribution
- Collaborative completion: simultaneous continuation of contribution by other participant
- "Early response": other participant interrupts an ongoing presentation phase of a contribution by initiating the next contribution before the current one is fully completed
- Clarification request: other participant interrupts an ongoing presentation phase of a contribution by initiating an cembedded clarification contribution

Summary

- Conversation is a form of joint activity, requiring joint closure
- Participants work hard to ground their joint actions, i.e., to establish them as common ground
- Contributors presents signals and both contributors and respondents work together to reach mutual belief that signals have been understood well enough for the current purposes
- Contributions emerge in an infinite variety of patterns: concluded, continuing, and others

Dialogue Acts

From Speech Acts to Dialogue Acts

- Austin's locutionary, illocutionary and perlocutionary acts (simultaneity)
- Novick's meta-locutionary acts (additional level)
- Traum and Hinkelman's conversational act types (multilevel and multiagent)
  - Turn-taking CAs, e.g., take-turn, keep-turn, release-turn, assign-turn
  - Grounding CAs, e.g., initiate, continue, acknowledge, repair, request-repair, request-acknowledgment, cancel
  - Core speech acts, e.g., inform, wh-question, y/n-question, accept, request, reject, suggest, evaluate, request-permission, offer, promise
  - Argumentation CAs, e.g., elaborate, summarize, clarify, Q&A, convince, find-plan (similar to rhetorical relations)
- Bunt's communicative functions as context updates along various dimensions
- Allwood's classification of communicative acts, including also non-verbal ones
- Core and Allen's Dialogue Act Markup in Several Layers (DAMSL)

Dialogue Act Annotation in Corpora

- Motivation:
  - Empirical grounding and verification of dialogue theories
  - Empirically based development of automated systems
  - Training and testing of automatic DA recognition

- (Some) Characteristics
  - human-human vs. human-computer (or Wizard-of-Oz)
  - contact (face-to-face) vs. distant (e.g., telephone)
  - general conversation vs. task-oriented
  - spontaneous vs. controlled vs. Wizard-of-Oz
  - text vs. speech, multimodality, language, etc.

- DA annotation schemes derived from a standard and/or corpus-specific

Dialogue Act Markup in Several Layers (DAMSL)

- a general DA annotation scheme standard, endorsed by the Discourse Resource Initiative (DRI)
- described in [Core and Allen1997, Carletta et al.1997]
- domain (task) independent, abstract DA categories
- several levels of information about utterance function(s):
  - forward-looking communicative function (i.e., speech act)
  - backward-looking communicative function (i.e., relationship to some previous speech act)
  - utterance features:
    - information level (i.e., relevance of semantic content to task/task-management/communication-management/other)
    - communicative status (i.e., completeness, intelligibility, interpretability),
    - syntactic features (e.g., form)

DAMSL: Forward Looking Functions

statement	a claim
info-request	a question
check	a question confirming info
influence on addressee	
open-option	a weak suggestion or list of options
action-directive	command or instruction
influence on speaker	
offer	offer to do something
commit	commitment to do something
conventional	
opening	
closing	
thanking	

DAMSL: Backward-looking functions

They are characterized along 4 dimensions:

- Understanding: speaker's ability to recover the semantic content (grounding)
  - signal understanding, signal non-understanding, completion, re-realize

- Agreement: speaker's attitude toward an action, plan, object, etc.
  - closing acts: accept, accept part, non-accept, reject part, reject;
  - non-closing acts: hold

- Answer

- Informational relations: relationships between the content of the current utterance and the utterance it responds to (e.g., consequence) – cf. RST

DAMSL: Backward Looking Functions

- Agreement
  - Accept
  - Accept-part
  - Maybe
  - Reject-part
  - Reject
  - Hold
- Answer
- Understanding
  - Signal-non-und
  - Signal-und
  - Acknowledge
  - Repeat-rephrase
  - Completion

DAMSL Annotation Example

(cf. [Jurafsky and Martin2000][pp.729–732])

(15) C: I need to travel in May.

(16) A: And, what day in May did you want to travel?

(17) C: OK,
uh, I need to be there for a meeting that's from the 12th to the 15th.

(18) A: And you're flying into what city?

(19) C: Seattle.

(20) A: And what time would you like to leave Pittsburgh?

(21) C: Uh hmm I don't think there's many options for non-stop.

(22) A: Right.
There's three non-stops today.

(23) C: What are they?

(24) A: The first departs PGH at 10am and arrives Seattle at 1205 their time.
The second flight departs PGH at 555pm, arrives Seattle at 8pm.
And the last flight departs at 815pm arrives Seattle at 1028pm.

(25) C: OK,
I'll take the 5ish flight on the night before on the 11th.

(26) A: On the 11th?
OK.
Departing at 555pm arrives Seattle at 8pm, US Air flight 115.

(27) C: OK.

Conclusions

- language as action
- multifunctionality of utterances in dialogue
- multidimensional DA schemes, general vs. application-specific
- annotated corpora (reusability)
- usefulness in theory development and building practical dialogue systems

References

[Carletta et al.1997] Jean Carletta, Nils Dahlbäck, Norbert Reithinger, and Marylin A. Walker. 1997. Standards for dialogue coding in natural language processing. Report on the dagstuhl seminar, Discourse Resource Initiative, February 3–7.

[Clark1996] Herbert Clark. 1996. *Using Language*. Cambridge University Press, Cambridge.

[Core and Allen1997] Mark Core and James Allen. 1997. Coding dialogs with the damsl annotation scheme. In *Proceedings of the AAAI Fall Symposium on Communicative Action in Humans and Machines*, pages 28–35, Boston, MA, November.

[Grice1975] H. P. Grice. 1975. Logic and conversation. In P. Cole and J. Morgan, editors, *Syntax and semantics*, number 3. Academic Press, New York.

[Grosz and Sidner1986] Barbara Grosz and Candy L. Sidner. 1986. Attention, intentions and the structure of discourse. *Computational linguistics*, 12:175–204.

[Jurafsky and Martin2000] Daniel Jurafsky and James H. Martin. 2000. *Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. Prentice Hall Series in Artificial Intelligence. Prentice Hall. url.

[Lewis1969] David Lewis. 1969. *Convention: a Philosophical Study*. Harvard University Press, Cambridge MA.

[Stalnaker1974] Robert Stalnaker. 1974. Pragmatic presuppositions. In Milton Munitz and Peter Unger, editors, *Semantics and Philosophy*, pages 197–214. New York University Press, New York.