



CS 115 Lecture 5

Dialog

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Professor Meteor



+ Conversational Agents



- AKA:
 - Spoken Language Systems
 - Dialogue Systems
 - Speech Dialogue Systems
- Applications:
 - Travel arrangements (Amtrak, United airlines)
 - Telephone call routing
 - Tutoring
 - Communicating with robots
 - Anything with limited screen/keyboard

+ A travel dialog: Communicator

Xu and Rudnicky (2000)



S1: Hello. You've reached the [Communicator]. Tell me your full name.

U2: Hi, I'd like to fly to Seattle Tuesday morning

S3: Traveling to Seattle on Tuesday, August 11th in the morning. Your full name?

U4: John Doe

S5: Hello, John. I'm glad to hear from you **again**. **OK**. Let's see, I have a United flight departing Pittsburgh at 10:45 am arriving into Seattle at 1:57 pm. **Is that OK?**

U6: Yes

S7: Will you return to Pittsburgh from Seattle?

U8: No, I will go on to Los Angeles

S9: **Travelling to Los Angeles** on what date

U10: Sorry, can we go back to the previous **leg** again

S11: For the first leg, you are on United flight 1446 departing Pittsburgh at 10:45 AM tomorrow, arriving in Seattle at 1:57 PM. Do you want to take that?

U12: Actually, I want to leave Wednesday

S13: A flight Wednesday. I have a flight departing Pittsburgh at 10:45 AM tomorrow, arriving in Seattle at 1:57 PM. Is that OK?

U:14 Yes.

+ Linguistics of Human Conversation



- Turn-taking
- Speech Acts
- Grounding
- Conversational Structure
- Implicature

+ Turn-taking



- Dialogue is characterized by turn-taking.

- A:

- B:

- A:

- B:

- ...

- Resource allocation problem:

- How do speakers know when to take the floor?

+ Turn-taking rules

Sacks et al. (1974)

- At each transition-relevance place of each turn:
 - a. If during this turn the current speaker has selected B as the next speaker then B must speak next.
 - b. If the current speaker does not select the next speaker, any other speaker may take the next turn.
 - c. If no one else takes the next turn, the current speaker may take the next turn.



+ Implications of subrule a



- For some utterances the current speaker selects the next speaker
 - Adjacency pairs
 - Question/answer
 - Greeting/greeting
 - Compliment/downplayer
 - Request/grant
- Silence between 2 parts of adjacency pair is different than silence after
 - A: Is there something bothering you or not?
 - (1.0)
 - A: Yes or no?
 - (1.5)
 - A: Eh
 - B: No.
- Consider this in the context of a slow to respond speech system

+ Speech Acts



- Austin (1962): An utterance is a kind of action
- Clear case: **performatives**
 - I name this ship the Titanic
 - I second that motion
 - I bet you five dollars it will snow tomorrow
- Performative verbs (name, second)
- Austin's idea: not just these verbs

+ Each utterance is 3 acts



- **Locutionary act:** the utterance of a sentence with a particular meaning
- **Illocutionary act:** the act of asking, answering, promising, etc., in uttering a sentence.
- **Perlocutionary act:** the (often intentional) production of certain effects upon the thoughts, feelings, or actions of addressee in uttering a sentence.

+ Locutionary and illocutionary



- “You can’t do that!”
- Illocutionary force:
 - Protesting
- Perlocutionary force:
 - **Effect** of annoying addressee
 - **Effect** of stopping addressee from doing something

+ The 3 levels of act revisited



	Locutionary Force	Illocutionary Force	Perlocutionary Force
Can I have the rest of your sandwich? Or Are you going to finish that?	Question	Request	Effect: You give me sandwich (or you are amused by my quoting from "Diner") (or etc)
I want the rest of your sandwich	Declarative	Request	Effect: as above
Give me your sandwich!	Imperative	Request	Effect: as above.

+ 5 classes of speech acts: Searle (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
 - (*I resign; You're fired*)

+ Verbmobil Dialogue Acts



THANK	thanks
GREET	Hello Dan
INTRODUCE	It's me again
BYE	All right, bye
REQUEST-COMMENT	How does that look?
SUGGEST	June 13th through 17th
REJECT	No, Friday I'm booked all day
ACCEPT	Saturday sounds fine
REQUEST-SUGGEST	What is a good day of the week for you?
INITIATE	I wanted to make an appointment with you
GIVE_REASON	Because I have meetings all afternoon
FEEDBACK	Okay
DELIBERATE	Let me check my calendar here
CONFIRM	Okay, that would be wonderful
CLARIFY	Okay, do you mean Tuesday the 23rd?

+ DAMSL (Dialog Act Markup in Several Layers)



- DAMSL distinguishes four dimensions according to the unit's purpose and role in dialogue:
 - **Communicative status**: whether utterance is intelligible and whether it was successfully completed (uninterpretable, abandoned, self-talk)
 - **Information level**: abstract characterization of the semantic content
 - Task: utterances that advance the task
 - Task-management: utterances that discuss the problem solving process or experimental scenario
 - Communication management: conventional phrases that maintain contact, perception, and understanding during the communication process: greetings, closings, acknowledgements ("Okay", "uh-huh"), stalling for time ("Okay", "Let me see"), signals of speech repairs ("oops") or misunderstandings ("sorry?", "huh?")
 - Other-level
 - **Forward-looking function**: characterizes what effect an utterance has on subsequent dialogue and interaction
 - **Backward-looking function**: captures the way the current utterance is related to the previous dialogue

+ Forward looking (2006)



- Statement:
 - Asserts and other acts where the speaker makes a claim about the world (modified in Core et al., 1998 to also allow statements to be claims about the communication).

- Info-request:
 - Speaker requests Hearer (by just asking or in another, indirect way) to provide information.

- Influencing-addressee-future-action:
 - Speaker is suggesting potential action to Hearer, beyond answering a request for information.

- Committing-speaker-future-action:
 - Speaker is potentially committing himself to perform a future action.

- Conventional:
 - Opening or Closing, i.e. Speaker summons Hearer and/or starts the interaction, or Speaker closes the dialogue or is dismissing Hearer.

+ Backward looking (2006)



■ Agreement:

- Speaker is addressing a previous proposal, request, or claim, with the possibility of accepting or rejecting all or part of the proposal, request or claim; of withholding his attitude towards the proposal, request, or claim; or stating his attitude while being non-committal to the proposal., request, or claim.

■ Understanding:

- Utterances concerning the understanding between Speaker and Hearer, ranging from merely hearing the words to fully identifying intention.

■ Answer:

- Standard reaction of Speaker to an Info-request action by Hearer.

■ Information-relation:

- Tag which should capture how the content of this utterance relates to the content of its antecedent (still subject of further study).

+ A DAMSL Labeling

Label	Utterance
Assert	C1: ...I need to travel in May
Info-request, ack.	A1: And what day in May did you want to travel
Assert, answer	C2: OK, uh, I need to be there for a meeting that's from the 12th to the 15th
Info-request, ack.	A2: And your flying into what city?
Assert, answer	C3: Seattle
Info-request, ack.	A3: And what time would you like to leave Pittsburgh?
Check, hold	C: Uh hmm, I don't think there's many options for a nonstop.?
Accept, ack.	A: Right,
Assert	there's only three non-stops today
Info-request	A: What are they?
Assert, open-option	C: The first one leaves PGH at 10 am ...
Accept, ack.	A: I'll take the 5ish one ...
Check, ack.	C: On the 11th?

+ Automatic Interpretation of Dialogue Acts



- How do we automatically identify dialogue acts?
- Given an utterance:
 - Decide whether it is a QUESTION, STATEMENT, SUGGEST, or ACK
- Recognizing illocutionary force will be crucial to building a dialogue agent
- Perhaps we can just look at the form of the utterance to decide?

+ Can we just use the surface syntactic form?



- YES-NO-Q's have auxiliary-before-subject syntax:
 - Will breakfast be served on USAir 1557?
- STATEMENTS have declarative syntax:
 - I don't care about lunch
- COMMAND's have imperative syntax:
 - Show me flights from Milwaukee to Orlando on Thursday night

+ Surface form != speech act type



	Locutionary Force	Illocutionary Force
Can I have the rest of your sandwich?	Question	Request
I want the rest of your sandwich	Declarative	Request
Give me your sandwich!	Imperative	Request



Dialogue act disambiguation is hard!

Who's on First?



Abbott: Well, Costello, I'm going to New York with you. Bucky Harris the Yankee's manager gave me a job as coach for as long as you're on the team.

Costello: Look Abbott, if you're the coach, you must know all the players.

Abbott: I certainly do.

Costello: Well you know I've never met the guys. So you'll have to tell me their names, and then I'll know who's playing on the team.

Abbott: Oh, I'll tell you their names, but you know it seems to me they give these ball players now-a-days very peculiar names.

Costello: You mean funny names?

Abbott: Strange names, pet names...like Dizzy Dean...

Costello: His brother Daffy Abbott: Daffy Dean...

Costello: And their French cousin.

Abbott: French?

Costello: Goofe'

Abbott: Goofe' Dean. Well, let's see, we have on the bags, Who's on first, What's on second, I Don't Know is on third...

Costello: That's what I want to find out.

Abbott: I say Who's on first, What's on second, I Don't Know's on third.

+ Dialogue Act ambiguity



- Can you give me a list of the flights from Atlanta to Boston?
 - This looks like an INFO-REQUEST.
 - If so, the answer is:
 - YES.
 - But really it's a DIRECTIVE or REQUEST, a polite form of:
 - Please give me a list of the flights...
- What looks like a QUESTION can be a REQUEST

+ Grounding



- Why do elevator buttons light up?
- Clark (1996) (after Norman 1988)
 - *Principle of closure*. Agents performing an action require evidence, sufficient for current purposes, that they have succeeded in performing it
- What is the linguistic correlate of this?

+ Grounding



- Need to know whether an action succeeded *or failed*
- Dialogue is also an action
 - a **collective action** performed by speaker and hearer
 - **Common ground**: set of things mutually believed by both speaker and hearer
- Need to achieve common ground, so hearer must **ground** or **acknowledge** speakers utterance.

+ How do speakers ground?

Clark and Schaefer



- Continued attention:
 - B continues attending to A
- Relevant next contribution:
 - B starts in on next relevant contribution
- Acknowledgement:
 - B nods or says continuer like *uh-huh*, *yeah*, assessment (*great!*)
- Demonstration:
 - B demonstrates understanding A by paraphrasing or reformulating A's contribution, or by collaboratively completing A's utterance
- Display:
 - B displays verbatim all or part of A's presentation

+ A human-human conversation



C: ...I need to travel in May

A: And what day in May did you want to travel

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

A: And your flying into what city?

C: Seattle

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

C: Uh hmm, I don't think there's amny options for a nonstop.

A: Right, there's only three non-stops today

A: What are they?

....

+ Grounding examples



■ Display:

C: I need to travel in May

A: And, what day **in May** did you want to travel?

■ Acknowledgement

C: He wants to fly from Boston

A: **mm-hmm**

C: to Baltimore Washington International

- [Mm-hmm (usually transcribed “uh-huh”) is a backchannel, continuer, or acknowledgement token]

+ Grounding Examples (2)



- Acknowledgement + next relevant contribution
 - And, what day in May did you want to travel?
 - And you're flying into what city?
 - And what time would you like to leave?
- The “and” indicates to the client that agent has successfully understood answer to the last question.

+ Grounding negative responses

From Cohen et al. (2004)



■ System: Did you want to review some more of your personal profile?

■ Caller: No.

■ System: Okay, what's next?

Good!

■ System: Did you want to review some more of your personal profile?

■ Caller: No.

■ System: What's next?

Bad!

+ Grounding and Dialogue Systems



- Grounding is not just a tidbit about humans
- Is key to design of conversational agent
- Why?
 - HCI researchers find users of speech-based interfaces are confused when system doesn't give them an explicit acknowledgement signal
 - Stifelman et al. (1993), Yankelovich et al. (1995)

+ Why is this customer confused?



- Customer: (rings)
- Operator: Directory Enquiries, for which town please?
- Customer: Could you give me the phone number of um, Mrs. um, Smithson?
- Operator: Yes, which town is this at please?
- Customer: Huddleston.
- Operator: What listing?
- Operator: Yes. And the name again?
- Customer: Mrs. Smithson

+ Conversational Structure



- Telephone conversations
 - Stage 1: Enter a conversation
 - Stage 2: Identification
 - Stage 3: Establish joint willingness to converse
 - Stage 4: First topic is raised, usually by caller

Stage	Speaker & Utterance
1	A ₁ : (rings B's telephone)
1,2	B ₁ : Benjamin Holloway
2	A ₁ : this is Professor Dwight's secretary, from Polymania College
2,3	B ₁ : ooh yes –
4	A ₁ : uh:m . about the: lexicology *seminar*
4	B ₁ : *yes*

+ Conversational Implicature



- **A: And, what day in May did you want to travel?**
- **C: OK, uh, I need to be there for a meeting that's from the 12th to the 15th.**
- Note that client did not answer question.
- Meaning of client's sentence:
 - Meeting
 - Start-of-meeting: 12th
 - End-of-meeting: 15th
 - Doesn't say anything about flying!!!!
- What is it that licenses agent to infer that client is mentioning this meeting so as to inform the agent of the travel dates?

+ Conversational Implicature (2)



- A: ... **there's 3 non-stops today.**
- This would still be true if 7 non-stops today.
- But no, the agent means: 3 and only 3.
- How can client infer that agent means:
 - *only 3*

+ Grice: conversational implicature



- Implicature means a particular class of licensed inferences.
- Grice (1975) proposed that what enables hearers to draw correct inferences is:
 - Cooperative Principle
 - This is a tacit agreement by speakers and listeners to cooperate in communication

+ 4 Gricean Maxims



- Relevance: Be relevant
- Quantity: Do not make your contribution more or less informative than required
- Quality: try to make your contribution one that is true (don't say things that are false or for which you lack adequate evidence)
- Manner: Avoid ambiguity and obscurity; be brief and orderly

+ Relevance



- A: Is Regina here?
- B: Her car is outside.
- Implication: yes
 - Hearer thinks:
 - Why mention the car?
 - It must be relevant.
 - How could it be relevant?
 - It could since: if her car is here she is probably here.
- Client: I need to be there for a meeting that's from the 12th to the 15th
 - Hearer thinks:
 - Speaker is following maxims, would only have mentioned meeting if it was relevant. How could meeting be relevant?
 - If client meant me to understand that he had to depart in time for the mtg.

+ Quantity



- A: How much money do you have on you?
- B: I have 5 dollars
 - Implication: not 6 dollars
- Similarly, 3 non stops can't mean 7 non-stops
 - Hearer thinks:
 - If speaker meant 7 non-stops she would have said 7 non-stops
- A: Did you do the reading for today's class?
- B: I intended to
 - Implication: No
 - B's answer would be true if B intended to do the reading AND did the reading, but would then violate maxim

+ Words with implications



presumably

trivial

committed to
[something]

a dozen

corroborate

assert

ambiguous

arising with

technically

inference

implication

plausible

weird

intuitively

Only

The other one

+ Grice Incorporated



Laila Dybkjær, Niels Ole Bernsen and Hans Dybkjær

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- Conducted Wizard of Oz study (WoZ) and analyzed “Cooperativeness” then compared the principles they observed with Grice’s maxims

- Group 1: Informativeness
 - Make your contribution as informative as is required (for the current purposes of the exchange).
 - Be fully explicit in communicating to users the commitments they have made.
 - Provide feedback on each piece of information provided by the user.
 - Do not make your contribution more informative than is required.

+ Grice Incorporated



■ Group 2: Truth and evidence

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

■ Group 3: Relevance

- *Be relevant, i.e. Be appropriate to the immediate needs at each stage of the transaction.

■ Group 4 Manner

- Provide same formulation of the same question (or address) to users everywhere in the system's dialogue turns.
- Be brief (avoid unnecessary prolixity).
- Be orderly.

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■ Group 5 Partner asymmetry

- Inform the dialogue partners of important non-normal characteristics which they should take into account in order to behave cooperatively in dialogue.
- Provide clear and comprehensible communication of what the system can and cannot do.
- Provide clear and sufficient instructions to users on how to interact with the system.

■ Group 6: Background knowledge

- Take partners' relevant background knowledge into account.
- Take into account possible (and possibly erroneous) user inferences by analogy from related task domains.
- Separate whenever possible between the needs of novice and expert users (user-adaptive dialogue).
- Take into account legitimate partner expectations as to your own background knowledge.
- Provide sufficient task domain knowledge and inference.

+ Grice Incorporated



■ Group 7: Repair and Clarification

- Initiate repair or clarification meta-communication in case of communication failure.
- Provide ability to initiate repair if system understanding has failed.
- Initiate clarification meta-communication in case of inconsistent user input.
- Initiate clarification meta-communication