If people have everything they need, or can get it

More often, people and computer systems need to work

Working out the reason that the speaker did what

This involves hearing what was said, then breaking up

Working out the literal meaning of what was said

A first step toward building a computer that can do the

Speaking and listening in an orderly way, without talking

Checking that the other person is understanding.

Trying to involve a computer in dialog makes the
difficulties more evident

A refusal is often heavily disguised so as to soften the

A question is usually followed by an answer

We can book airline tickets over the phone without

We can interact with our computer while keeping our

Why to speak

Accurately noticing what the speaker said

This involves hearing what was said, then breaking up

What to say

How to say it

Both perspectives

Communicating is a collaborative event

The speaker and the listener must manage the following processes, in real-time:

1. Speaking and listening in an orderly way, without talking

   over each other more than is acceptable.

2. Checking that the other person is understanding.

3. Fixing confusions and misunderstandings before they cause the conversation to break down.

Human beings are skilled in this activity long before they enter pre-school

Trying to involve a computer in dialog makes the difficulties more evident

One of the main reasons for using language is in order to

One question is usually followed by an answer

A request is often made indirectly because outright
demands feel rude

A refusal is often heavily disguised so as to soften the

impact of the unexpected and unwelcome response

Why dialogue?

Human dialogue

Basic facts

Dialogue moves

Speech acts

Rules

Early dialogue systems

Old

New

Other categories

Modern dialogue systems

Introduction

Based on Dickinson, Brew, & Meurers (2013)

Indiana University

Fall 2013
Automating dialogue

A sample dialog from the Let's Go system
(http://www.speech.cs.cmu.edu/letsgo/example.html)

s: Thank you for calling the CMU Let's Go! Bus
Information System. This conversation will be recorded
for research purposes. If you do not want to be
recorded, please hang up now. What can I do for you?

u: I would like to go to the airport tomorrow morning.
s: To the airport. When do you want to arrive?
u: I'd like to arrive at 10:30.
s: Arriving at around 10:30 AM. Where do you want to
leave from?
u: I'd like to leave from Carnegie Mellon.
s: From Carnegie Mellon. There is a 28X leaving Forbes
Avenue at Morewood at 9:20 AM. It will arrive at Greater
Pittsburgh Airport at Departure Stops at 10:15 AM.

Human dialogue

How does dialogue, or discourse (= conversation), work?

We will look at a few aspects of human-human interactions:
▶ Basic facts about dialogues
▶ Organization of conversation: Dialogue moves
▶ What utterances do: Speech acts
▶ Rules of conversation: Gricean maxims

Basic facts about dialogues

Utterances

People do not necessarily speak in sentences

▶ Utterances: basic unit of conversation
  ▶ may span over several turns
  ▶ may have several utterances within one turn

AGENT: Yeah yeah the um let me see here
we've got you on American flight
nine thirty eight

CUSTOMER: Yep.
AGENT: leaving on the twentieth of June
out of Orange County John Wayne
Airport at seven thirty p.m.
CUSTOMER: Seven thirty.
AGENT: and into uh San Francisco at eight
fifty seven.

Dialogues (2)

u: When's the next bus?
s: There is a 28X leaving Forbes Avenue at Morewood at
9:40 AM. It will arrive at Greater Pittsburgh Airport at
Departure Stops at 10:35 AM.

u: I'd like to go from the airport back to CMU on Friday.
s: Leaving at around 6:15 PM. There's a 28X leaving
Greater Pittsburgh Airport at Departure Stops at 6:26
PM. It will arrive at Forbes Avenue at Morewood at 7:20
PM.

u: Thank you very much.
**Basic facts about dialogues**

**Common ground:** the set of things which both speakers believe to be true of the conversation.
- Part of classroom common ground is that we are at Indiana in a linguistics class. Not part of the common ground is what I had for breakfast.
- People assess what others know before making a new contribution

**Grounding**

In order to establish common ground, speakers do various things:
- **Backchannels** = short utterance which indicates the utterance was heard and that the speaker should continue.
  - A: That’s a nice shirt.
  - B: Mm-hmm.
- Acknowledgment of utterance: continued attention, completing speaker’s utterance, and so on
- Asking clarifying questions

**Dialogue moves**

Can view dialogue as a series of moves, as in a game

1. As an exchange has to start somewhere, we can group together a set of initiating moves
   - Making an assertion ("you have a friendly face")
   - Issuing a command or making a request ("let’s go and have a bite to eat")
   - Asking a question ("are you doing anything tonight?")

**Dialogue moves (2)**

2. Some moves are responses to the previous move
   - Saying "yes" or "no" to a question where the person was seeking information
   - Giving an answer to an information-seeking question that needs more than "yes" or "no"
   - Answering the question, but then providing more information than was strictly asked for
   - Agreeing to do something (e.g., saying "ok" to "let’s go and have a bite to eat")
   - Refusing to do something (e.g., saying "no" to "let’s go and have a bite to eat")
   - Maybe agreeing to do something (e.g., saying "maybe")
   - Partially agreeing to do something (e.g., saying "ok, if we’re quick")
   - Partially refusing to do something (e.g., saying "no, unless you pay")

**Dialogue moves (3)**

3. Others are responses, more or less, but divert the conversation from its expected path—dialog management moves
   - Saying “huh?” when you didn’t hear.
   - Saying “I don’t think I understand” in response to something you didn’t understand
   - Saying "I can't believe you said that" when you did hear what the other person said, find it offensive or unacceptable, and want them to retract it
   - Saying “I take it back” when you want the other person to pretend that you haven’t said what you just did

**Discourse structure**

**Discourse**, or dialogue, has some structure to it—not just a bunch of random, loosely-connected statements.

- Every discourse has a **discourse purpose** = a reason for talking (Grosz and Sidner 1986)
- Purpose is clearer in **task-based dialogues** = speakers are trying to achieve some goal together
  - e.g., giving directions or fixing a car

If we figure out the discourse structure automatically, the computer can keep track of what's going on.
- Know what topics are appropriate
- Better able to know what pronouns and definite noun phrases (e.g., the dog) refer to.
Speech acts

What does each utterance do? How does it function?
- Utterances often equated with actions (Austin 1962)

For example, there are performative verbs; by saying them, you actually do what you say
- I (hereby) christen this ship The Swarthy.
- I pronounce you man and wife.
- I second that motion.
- I bet you five dollars the Hoosiers will win the NCAA championship this year.

Speech acts (2)

Speech acts help us to understand what is really going on when people say, e.g., “could you pass the salt?”
- Syntactic form of a question
- In many contexts, the speech act that it implements is a polite command

For dialogue systems, importance is to recognize that utterances may not be exactly what they seem
- Some standard patterns:
  - use of questions to stand for commands
  - use of objectively unnecessary, informative statements to stand for requests (e.g., using “you are blocking my view” vs. “get out of my eyeline”)

Common speech acts: informing, reminding, inviting, complaining, refusing, accepting, requesting, commanding

Speech acts (3)

Preconditions & effects

Speech acts can be broken down into preconditions and effects
- e.g., informing someone that a concert is on Friday

  - Preconditions:
    - actually know that the concert is on Friday
    - the other person does not know when the concert is
  - Effect: the other person knows that the concert is on Friday

Automated systems often explicitly represent speech acts in terms of preconditions & effects

Indirect Speech Acts

Speech acts can be direct or indirect
- Direct: Form matches meaning.
  - A: Please take out the garbage.
    - imperative structure & imperative meaning
  - Indirect: The form and the meaning are different.
    - A: The garbage isn’t out yet.
      - declarative structure but imperative/directive meaning
    - A: Could you take out the garbage?
      - interrogative structure but imperative/request meaning

⇒ How do we encode such distinctions in a computer?

Using DAMSL in a computer

Using the DAMSL scheme,
- People annotate a text, or a corpus
- People can train a system on it and attempt to mark a new text with these labels.
- People can use the functions to tell a dialogue system what to do next
  - The system keeps track of the previous forward-looking function to know how to respond.
  - If a dialogue system needs an answer, it knows what kind of forward-looking function to use to get the human to provide one

But if a dialogue system wants to know what to do next, it needs more than forward and backward-looking functions...
Rules of Conversation: Gricean Maxims

When people speak “indirectly,” it’s usually clear what they mean.

⇒ They obey what Grice (1975) referred to as the four maxims (rules) or conversation.
  ▶ All based on the cooperative principle
    ▸ speakers are both trying to contribute to the purposes of the conversation.
    ▸ We use these to infer what a speaker is really saying.

Gricean maxim 1: Quantity

Quantity: Be exactly as informative as is required.

▶ Make your contribution as informative as is required (for the current purposes of the exchange)
  
  A: How many pencils do you have?
  B: Two.

⇒ means exactly two (or would have said more)

▶ Do not make your contribution more informative than is required.

Gricean maxim 2: Quality

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

Violation:
A: Do you know how to drive a stick-shift?
B: Yes, I do. I’ve seen my dad do it many times.

Gricean maxim 3: Relevance

Relevance: Be relevant.

A: Is Gail dating anyone these days?
B: Well, she goes to Indianapolis every weekend.

We make an inference that Gail is dating somebody in Indianapolis.

▶ Otherwise, B’s statement doesn’t make much sense.

Gricean maxim 4: Manner

Manner: Be perspicuous (easy to understand).

▶ Avoid obscurity of expression
  ▸ In other words, avoid jargon when it’s not a part of the common ground, e.g., words like proximity
▶ Avoid ambiguity
▶ Be brief (avoid unnecessary prolixity)
  ▸ Similar to maxim of quantity, but think here of long-winded conversations that provide the same amount of information as a shorter one
▶ Be orderly

ELIZA

We’ll start our tour of early dialogue systems with a quick tour of ELIZA.

▶ Written by Joseph Weizenbaum in the mid-1960s
▶ Simulation of a (Rogerian) psychotherapist.
  ▸ Rogerian therapist asks questions and gives backchannels more than providing advice
▶ User types questions, and ELIZA responds.

For some, the test of such a system is how human-like it is:

▶ If I can tell I am interacting with a computer, it has failed the Turing Test.
### Example conversation

**Taken from Weizenbaum's 1966 paper:**

**USER:** Men are all alike.

**ELIZA:** IN WHAT WAY?

**USER:** They're always bugging us about something or other.

**ELIZA:** CAN YOU THINK OF A SPECIFIC EXAMPLE?

**USER:** Well, my boyfriend made me come here.

**ELIZA:** YOUR BOYFRIEND MADE YOU COME HERE

**USER:** He says I'm depressed much of the time.

**ELIZA:** I AM SORRY TO HEAR YOU ARE DEPRESSED

**USER:** It's true. I am unhappy

**ELIZA:** DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY

### Example conversation (cont.)

**USER:** You are not very aggressive but I think you don't want me to notice that.

**ELIZA:** WHAT MAKES YOU THINK I AM NOT VERY AGGRESSIVE

**USER:** You don't argue with me.

**ELIZA:** WHY DO YOU THINK I DON'T ARGUE WITH YOU

**USER:** You are afraid of me.

**ELIZA:** DOES IT PLEASE YOU TO BELIEVE I AM AFRAID OF YOU

**USER:** My father is afraid of everybody.

**ELIZA:** WHAT ELSE COMES TO YOUR MIND WHEN YOU THINK OF YOUR FATHER

**USER:** Bullies.

**ELIZA:** DOES THAT HAVE ANYTHING TO DO WITH THE FACT THAT YOUR BOYFRIEND MADE YOU COME HERE

### How ELIZA works

They are many different implementations of ELIZA out there, but they all work in the same general way:

1. Transform input to change the point of view (I and you)
2. Perform pattern recognition (pattern matching)
3. Substitute keywords into canned phrases, or submit a general canned phrase

They can also more or less include some history of the conversation

### How can we tell that ELIZA isn't a human?

A number of clues tell us that ELIZA is a computer:

- Lack of initiative
- Lack of knowledge
- ELIZA knows nothing about the real world
- Lack of common sense
- Lack of true grammar/syntax = structure of sentences
  - Say you peabrain to it and you might get ME PEABRAIN back.
  - Need two separate patterns for Computers worry me very little, and I'm not worried much by computers.
- Doesn't have (much of) a memory

ELIZA also started a whole phenomenon of chatterbots

### PARRY

**PARRY** (Colby et al 1971)

- More verbal than ELIZA in some ways, i.e., talks for longer durations
- Keeps track of “global” emotional state
  - When the anger variable is high, for example, PARRY will choose from a set of “hostile” options.

“With PARRY, Dr. Colby established that a computer chip could be programmed to imitate a paranoid schizophrenic.”

http://www.edu-cyberpg.com/Linguistics/Parry.html
ALICE is a more advanced chatterbot, which won the 2004 Loebner Prize
- Loebner Prize = instantiation of the Turing Test: $100,000 for the first computer to pass the Turing Test (hasn’t happened yet)
- Each year, the most human-like computer wins $2000
You can chat with ALICE at: http://alice.pandorabots.com/

From Then Until Now

All of these chatterbots are just pattern-matchers, albeit of varying complexity
- There has been a push to add linguistic and real-world knowledge to dialogue systems
- Which is why we spent so much time talking about how real dialogue works