

Presentation 8: Understanding what you hear

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Sources of information for understanding

1. Sentence, or sentence fragment, uttered
"Do you accept credit cards?"

2. Current state of the common ground

Current joint activity, or social process:

Scene telephone call to restaurant

Participants potential customer, restaurant manager

Topic use of credit cards at restaurant

Communal common ground

What holds in this community

Social obligations: customer can ask manager for information

4

Susan calls up restaurant in Palo Alto

Susan to merchant

Susan Do you accept credit cards?

Merchant Uh, yes, we accept credit cards. But tonight we are closed.

Susan's apparent intentions

1. Pre-question Tell me *whether* you accept credit cards
2. Projected question Tell me *what credit cards* you accept.

Merchant's uptake

1. Pre-question "Yes, we accept credit cards"
2. Projected question [nothing]
3. Further information "But tonight we are closed"

2

Two problems for addressee

1. Understanding

What did the speaker mean?

As speaker's part of current joint activity

2. Uptake

What should I do on basis of speaker's meaning?

As my next part of current joint activity

3

Fundamental questions

1. How do listeners *combine* sources of information?
2. How do listeners *represent* information from utterances?

5

What you need to represent

Conversation what you and your partner say

Narrative what the narrator says

Novel what the novelist writes

Two types of representations

Textual phrase structure & propositions expressed

Situational situation in discourse so far

6

Example from Tangram study

"Um the next one's the person ice skating that has two arms"

7

Textual representation

(language used)

phrase structure

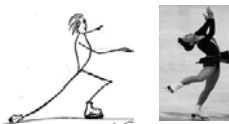
[the [next one]]
[is [the person][ice skating]
[that [has [two arms]]]]]

propositions expressed

x next(x), one(x)
x, y is(x, y)
y person(y), ice-skating(y)
y, z has(y, z)
z arm(z), two(z)

Situational representation

(imagined situation)



8

Textual vs. situational representations

Two bases for linguistic brevity

Textual representation:

Situational representation:

ellipsis
pronouns

9

Some facts

Textual brevity

1. Nobody else would take the garbage out, **so Bill did.**
2. The garbage needed to be taken out, **so Bill did.**

Why is 2 bad?

Situation-based brevity

1. Nobody else would take the garbage out, **so Bill did it.**
2. The garbage needed to be taken out, **so Bill did it.**

Why is 2 good here?

10

Ellipsis (Hankamer & Sag)

Nobody else would [take the garbage out]_{verb phrase}
so Bill did [x]_{verb phrase}
x = [take the garbage out]_{verb phrase}

The garbage [needed to be taken out]_{verb phrase}
so Bill did [x]
x ≠ [need to be taken out]_{verb phrase}

Conclusion

- Verb phrase ellipsis ["Bill did [x]_{verb phrase}"] requires the identical verb phrase in a previous utterance
- Verb phrase ellipsis makes reference to a *textual representation*

11

Pronouns (Hankamer & Sag)

Nobody else would take the garbage out,
so Bill did it
"it" refers to an event in the situation, taking the garbage out

The garbage needed to be taken out,
so Bill did it
"it" refers to an event in the situation, taking the garbage out

Conclusion

- Pronouns ["it"] require an identifiable object or event *in the situation*
- Pronouns make reference to a *situational representation*

12

Textual representation needed for ellipsis (Malt)

Question

Everyone was returning from vacation.
"Did Greg **see Maureen and Marjorie last night?**" Helen asked.
"I think they just got back in town."
"Yes, he did [...]." Sophia replied.

vs. statement

Everyone was returning from vacation.
"Greg **saw Maureen and Marjorie last night.**" Helen remarked.
"I think they just got back in town."
"Yes, he did [...]." Sophia replied.

How long to understand final sentence?

Faster in "question" sequence than in "statement" sequence

13

Textual representation needed for ellipsis (Malt)

Same focus

"I **liked the Monet exhibit,**" Heather remarked.
"It was really very nice."
"I did [...]" too," Richard replied.

vs. change focus

"I **liked the Monet exhibit,**" Heather remarked.
"Renoir is my favorite, though."
"I did [...]" too," Richard replied.

How long to understand final sentence?

Faster in "same focus" than in "change focus"

Malt's conclusion

"The system appears to retain information [in the textual representation] likely to be needed for interpreting subsequent utterances."

14

Situational representations

Creating them requires *inferences* beyond textual representations

15

Grice: Balance information and effort

Information

Enough: Be as informative as required by current joint activity
Not too much: Don't be more informative than required by current joint activity

Effort

Enough: Be clear
Not too much: Don't be wordy

To violate these is to imply something more

16

Two directions of inferences

Backward inferences

- Inferences that *seem required* to fit current utterance to the situational representation so far
- Example: bridging inferences, discourse relations

Forward inferences

- Inferences that seem justified by current utterance as additions to the situational representation
- Levinson heuristics

17

Backward inferences

Bridging inferences

Given-new strategy

- (1) Identify given and new information in utterance
- (2) Search situational representation for referent of given information
- (3) Add new information to that referent in situational representation

Example: "It was a diamond that John stole."

Step 1:

Given information: John stole X.
New information: X = a diamond

Step 2:

Search situational representation for event "John stole X"
If no event (if *not enough information*), add *bridging inference* to create event

Step 3:

Add new information to situational representation: X = a diamond

19

Bridging: Direct reference

Identity (no bridging):

I met a man yesterday. **The man I met yesterday** told me a story.

Pronouns (no bridging):

I met a man yesterday. **He** told me a story.

Epithets:

I met a man yesterday. **The bastard** stole all my money.

Set membership:

I met two people yesterday. **The woman** told me a story.

20

Bridging: Indirect reference by association

Necessary parts:

I looked into the room. **The ceiling** was very high.

Probable parts:

I walked into the room. **The windows** looked out into a garden.

Inducible parts:

I walked into the room. **The chandeliers** sparkled brightly.

21

Bridging: Indirect reference by characterization

Necessary roles:

There was a murder yesterday. The victim was a terrorist.

Inducible roles:

John was murdered yesterday. The knife lay nearby.

22

Bridging: Relations between utterances

Sequence (2 comes after 1) *and then*
John arrived at the party. He got himself a drink.

Reason (2 is the reason for 1) *because*
I'm not going to start learning Dutch. You can't teach an old dog new tricks.

Motivation (2 is caused by 1) *and therefore*
Go jogging with me this afternoon. You'll be full of energy.

Evidence (2 is evidence for 1) *I know because*
They're having a party again next door. I couldn't find a parking place.

Solutionhood (2 is a solution to 1) *so*
I'm hungry. Let's go the Fuji Gardens

23

Forward inferences

Levinson's heuristic 1

What isn't said isn't.

Example

Ann: Who else is coming to dinner tonight?

Ben: Tom, Dick, and Harry.

Implicature: Tom, Dick, and Harry are the **only** other people coming to dinner tonight

Example

Some of my friends are Democrats.

Implicature: Not all of my friends are Democrats

25

Levinson's heuristic 2

What is simply described is stereotypically exemplified

Example: The accountant dried her hands

Elaborative inference: She dried her hands in the ordinary way—on a napkin or towel

Memory experiment (Johnson, Bransford, and Solomon, 1973)

People heard: "The man dropped the delicate glass pitcher on the floor"

They later misrecognized: "The man *broke* the delicate glass pitcher on the floor."

Reading experiment (Garrod and Sanford, 1982)

1. Keith took his car to London. The car kept overheating.
2. Keith drove to London. The car kept overheating.

26

Levinson's heuristic 3

What's said in an abnormal way isn't normal

Abnormal description

1. Susan *stopped* the car.

2. Susan *caused* the car *to stop*.

In 1, Susan must have stopped the car in the **normal** way, e.g., with a footbrake

In 2, Susan must have stopped the car in an **abnormal** way, e.g., by yelling at the driver

Indirection (on telephone)

1. What time do you close tonight?

2. Would you mind telling me what time you close tonight?
The speaker must be trying to say something with the pre-sequence in 2

27

Creating textual representations

Heuristics in parsing

28

We need to divide utterances into their parts

Lewis Carroll: "The sun is shining on the sea"
reference to: the sun
predication to: shining on the sea
denotation of: shining
location: on the sea
reference to: the sea
declarative modality

Why do we need to parse utterances?

Goal: *compositional representation* of utterance
Identify sub-functions of utterance
Combine sub-functions in a compositional representation

Resources

Data driven: from sounds and gestures

Conceptually driven: situation representation + common ground

29

Principle of grouping

"Words that belong together mentally are placed together syntactically."

Or:

"Words that jointly refer to the same thing—object, event, or process—tend to be placed in a single constituent."

Noun phrases in all languages:

- the old man
- der alte Mann
- le vieil homme
- the man who left by the back door
- the man in the blue shirt

30

Principle of word order

"Relations among propositions are marked by word order."

English: modifier + noun (*blue car*)

German: modifier + noun (*blaues auto*)

vs.

French: noun + modifier (*voiture bleu*)

Spanish: noun + modifier (*coche azul*)

"Word pairs that are alike in function tend to have the same internal ordering."

31

Word order in English

Non-phrasal modifiers come before noun:

adjective + noun blue car

possessive + noun my car

noun modifier + noun police car

number + noun six cars

demonstrative + noun that car

Phrasal modifiers (heavier) come after noun:

noun + prepositional phrase car in my garage

noun + relative clause car that I own

noun + infinitive clause car to look into

32

Principle of agreement

"Words that belong together mentally tend to agree."

Or:

"Words that agree tend to refer to the same thing—objects, events, processes, or whatever."

Examples:

- He works (*sing*) vs. They work (*plural*)
- le soleil rond (*masculine*) vs. la lune ronde (*feminine*)
- die schöne Sonne (*fem*) vs. der schöne Mond (*masculine*)

33

Principle of case marking

English pronouns

- **She** left yesterday.
- **Her** I saw yesterday.
- **Hers** is in the garage.

German articles

- **Der** Junge sah mich. ("The boy saw me")
- **Dem** Junge gab ich ein buch ("To the boy I gave a book")
- **Den** Junge sah ich ("The boy I saw")

34

Discontinuous constituents in English

Relative clauses

- The woman **who had just arrived in town from New York** disappeared.

- The woman disappeared **who had just arrived in town from New York**.

- The woman **who had just arrived in town from New York** met a criminal.

- The woman met a criminal **who had just arrived in town from New York**.

Rule: Attach relative clause to nearest noun.

35

Problems of discontinuous constituents

Heavy interruptions

- John **looked** the address **up**.
- John **looked** the address of the friend he had visited in New York before he had flown to Europe **up**.
- John **figured** that Susan wanted to take the train to New York **out**.

Adjacent attachments

- John **said yesterday** that Mary had arrived.
- John **said** that Mary had arrived **yesterday**.
- John **said** that Mary will arrive **yesterday**.

Adjacent grouping

- One of my sisters' friend got married yesterday.

36

Still more discontinuous constituents

Separating subject and verb

- The criminal **that the reporter interviewed** escaped.
- The criminal that the reporter **that the newspaper set out on the assignment** interviewed escaped.

Separating *that*, *because*, *since* from its clause

- That Anna married Adam surprised him.
- That that Anna married Adam surprised him didn't surprise me.
- That that that Anna married Adam surprised him didn't surprise me should be news to my mother.
- Because since that Anna married Adam surprised him didn't surprise me wasn't even news to my mother, I quit.

37

Summary so far

People keep track of two models of what is said

1. *Textual* representation
2. *Situational* representation

Understanding requires two kinds of inferences

1. Backward inferences (e.g., bridging)
2. Forward inferences (Levinson's heuristics)

People identify relations *within* sentences by ...

- Grouping ("the old man")
- Word order ("man bites dog" vs. "dog bites man")
- Agreement ("I work" vs. "he works")
- Case marking ("I" vs. "me" vs. "my" vs. "mine")

38

Official record of chess game

White (Morphy)	Black (Anderssen)
1. P — K4	P — Q4
→ 2. P X P	Q X P
3. Kt — QB3	Q — QR4
4. P — Q4	P — K4
→ 5. P X P	Q X Pch

39

Interpreting "P X P" ("Pawn takes pawn")



White: P X P



White: P X P

Players interpret "P X P" against the current state of the game.

40