Chapter 22

Outline

- Communication
- Grammar
- Syntactic analysis
- Problems

Communicative acts (pre-1953): language consists of sentences that are true/false (cf. logic).

Modern view (post-1953): language is a form of action.

Wittgenstein (1953) Philosophical Investigations
Austin (1962) How to Do Things with Words
Searle (1969) Speech Acts

Why?

To change the actions of other agents.

Communicative acts (post-1953): language consists of sentences that are true/false (cf. logic).

Modern view (post-1953): language is a form of action.

Wittgenstein (1953) Philosophical Investigations
Austin (1962) How to Do Things with Words
Searle (1969) Speech Acts
Speech acts

SITUATION
Speaker
Utterance
Hearer

Speech acts achieve the speaker's goals:
- Inform
  - "There's a pit in front of you"
- Query
  - "Can you see the gold?"
- Command
  - "Pick it up"
- Promise
  - "I'll share the gold with you"
- Acknowledge
  - "OK"

Speech act planning requires knowledge of:
- Situation
- Semantic and syntactic conventions
- Hearer's goals, knowledge base, and rationality

Stages in communication (informing)

Intention
S wants to inform H that P
Generation
S selects words W to express P in context C
Synthesis
S utters words W
Perception
H perceives W in context C
Analysis
H infers possible meanings P1; : : : Pn
Disambiguation
H infers intended meaning Pi
Incorporation
H incorporates Pi into KB

How could this go wrong?
- Insincerity (S doesn't believe P)
- Speech wreck ignition failure
- Ambiguous utterance
- Difference understanding of current context (C6 = C0)

Wumpus lexicon

Noun
- stench
- breeze
- glitter
- nothing
- wumpus
- pit
- pits
- gold
- east
- j : : :

Verb
- is
- see
- smell
- shoot
- feel
- stinks
- go
- grab
- carry
- kill
- turn
- j : : :

Adjective
- right
- left
- east
- south
- back
- smelly
- j : : :

Adverb
- here
- there
- nearby
- ahead
- right
- left
- east
- south
- back
- j : : :

Pronoun
- me
- you
- I
- it
- j : : :

Name
- John
- Mary
- Boston
- UC Berkeley
- PAJAC
- j : : :

Article
- the
- a
- an
- j : : :

Preposition
- to
- in
- on
- near
- j : : :

Conjunction
- and
- or
- but
- j : : :

Digit
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
Wumpus grammar

Chapter 22

Real grammars to 500 pages; insucient even for proper English
Intersecting grammatical components make independent of semantics
- Don’t the wumpus the gold
- Shoot the wumpus the gold
- The gold the wumpus
- Adjusting L1 to agree with L2 is a learning problem

Grammaticality judgements

Formal language L1 may differ from natural language L2

* the gold grab the wumpus
* I smell the wumpus the gold
* I give the wumpus the gold

Intersubjective agreement somewhat reliable, independent of semantics

Real grammars 10{500 pages, insucient even for “proper” English

Parse trees

Exhibit the grammatical structure of a sentence

Wumpus grammar

Divided into closed and open classes
Pronoun
Verb
Article
Noun
Preposition
Conjunction
Digit
Adjective
Adverb
Pronoun
NP
VP
S

Chapter 22

Wumpus lexicon
Syntax in NLP

Most view syntactic structure as an essential step towards meaning;

Mary hit John

\[ = \]

John hit Mary

And since I was not informed— as a matter of fact, since I did not know

that there were excess funds until we, ourselves, in that checkup after the

whole thing blew up, and that was, if you'll remember, that was the incident

in which the attorney general came to me and told me that he had seen a

memo that indicated that there were no more funds."

Wouldn't the sentence 'I want to put a hyphen between the words Fish and Chips in my Fish-And-Chips sign' have been clearer if quotation marks had been placed before Fish, and between Fish and And, and And and And, and And and And, and And and And, and And and And, and And and And, and And and And, and And and And, and And and And, and And and And, as well as after Chips?"
Logical grammars contd.

Now it's easy to augment the rules:

\[
\text{N P} (s_1) ^ {\text{EatsBreakfast}} (\text{Ref}(s_1)) ^ {\text{V P}} (s_2)
\]

\[
\text{N P} (s_1) ^ {\text{Number}} (s_1; n) ^ {\text{V P}} (s_2) ^ {\text{Number}} (s_2; n)
\]

\[
\text{S} (\text{Append}(s_1; s_2))
\]

Parsing is reduced to logical inference:

\[
\text{Ask} (\text{KB}, S(\text{["I am a wumpus"]}))
\]

(\text{Can add extra arguments to return the parse structure, semantics})

Generation simply requires a query with uninstantiated variables:

\[
\text{Ask} (\text{KB}, S(x))
\]

If we add arguments to nonterminals to construct sentence semantics, NLP generation can be done from a given logical sentence:

\[
\text{Ask} (\text{KB}, S(x; \text{At}(\text{Robot}; 1; 1)))
\]

Real human languages provide many problems for NLP:

- Ambiguity
- Monosemous
- Metaphor
- Metonymy
- Discourse structure
- Vagueness
- Indexicality
- Anaphora
- Ambiguity

Real language

American pushes bottle on Germans

 helicopter powered by humans

Squad helps dog bite victim
Ambiguity can be lexical (polysemy), pragmatic, semantic, referential.

After Mary proposed to John, they found a preacher and got married.

Anaphora

Using pronouns to refer back to entities already introduced in the text.

I ate spaghetti with meatballs, salad.

Ambiguity

a fork

Ambiguity

abandon

Ambiguity

abandon

Helicopter powered by human legs.

Squad helps dog bite victim.

American pushes bottle up Germans.

Ambiguity
Anaphora

Using pronouns to refer back to entities already introduced in the text

After Mary proposed to John, they found a preacher and got married.

For the honeymoon, they went to Hawaii.

Mary saw a ring through the window and asked John for it.

Mary threw a rock at the window and broke it.

Indexicality

Indexical sentences refer to utterance situation (place, time, S/H, etc.)

I am over here.

Why did you do that?

Metonymy

Using one noun phrase to stand for another

I've read Shakespeare.

Chrysler announced record profits.

The ham sandwich on Table 4 wants another beer.

Metaphor

Non-literal usage of words and phrases, often systematic:

I've tried killing the process but it won't die. Its parent keeps it alive.

The noun phrase to refer back to entities already introduced in the text

Anaphora
Noncompositionality

basketball shoes
baby shoes
alligator shoes
designer shoes
brake shoes
red book
red pen
red hair
red herring
small moon
large molecule
mere child
alleged murderer
real leather
artificial grass