

## AI, November 6, 2006

I. Red tape. Exam on Wednesday through Friday's class, covering since last exam.

### II. Language

- A. Definition: phonetics, phonology, syntax, semantics, pragmatics ::  
sound, meaningful sound, form, meaning, purpose/use  
The first two levels are treated in §15.6, pp. 568–570; I will merely mention:  
p. 570 analog acoustic signal, break into phones; p. 569 phonemes

Example 1: “Spencer likes Patty-Susan.”

- spensr laikz p<sup>h</sup>ati-soozun. Phonetic
  - spensr laikz pati-soozun. Phonemic (rough transcription)
  - [s][p][e][n][s][aɪ]kz l[ay]kz p[æ]t[ɪ]s[uh]z[ɪ]n
- More precise DARPA phonemes English; text is right caption is wrong.

1a. Syntax is trees:

- (\*) • (S (NP (N (Nproper spencer))) (VP (V likes) (NP (N (Nproper patti-susan)))))  
• s( np( n( nproper spencer)), vp( v(likes), np( n( nproper patti\_susan))))  
Lisp versus Prolog way to do a tree.

1b. Semantics is trees too:

- likes(spencer, pattySusan).

1c. Pragmatics for a computer program might mean to execute the code that the semantics suggests. Is first in generation, last in recognition of a sentence.

- [Spoken by Patty-Susan's mother] ==> To let you know my daughter is popular.
- 10 print “hello” ==> hello

Example 2: “Will you open that?”

question(open(person12, object13)) you, that point somewhere in real world  
Pragmatics: Show me how many you are with tight jar lids!

B. What are purposes of language?

To order or request (imperative !), to question (interrogative ?),  
to inform, express feelings, promise, acknowledge (declarative .).  
To perform (performative, not declarative as on p. 791):  
I now pronounce you man and wife.  
I pray that your soul will prosper (St. John's third letter).  
I sentence you to three months in jail.

C. Grammar for syntax (quick review of OPL for Joe Prendergast's sake)

terminals words, or at least morphemes (smallest unit of structure)  
non-terminals parts of speech and their logical combinations ((\* above)

D. Ambiguity: Solution is to allow all levels to interact (“blackboard architecture”)

1. Sound: I’ve got a wee cough. I’ve got a week off.  
I want the night rate. I want the nitrate.
2. Syntax: He ate the cookies on the couch. [location of the cookie or the eating]  
a + b + c [which addition is to be done first?]
3. Semantic: The bank is too small. [river bank or financial institution]  
Lexical is a special case.
4. Pragmatic: George likes that. [to what does that refer?]  
I am running. [as a daily habit or evading the law?]  
My dad to me: “Will you take out the trash?” [me: Question;  
Dad: Rhetorical question, meaning  
“Take out the trash!”]

Literal versus figurative. See §22.6. To kick the bucket = to die or to turn over the bucket.

E. Parsing: See p. 797, using document camera. Use Prolog’s sentence.pl to show how it would work in Prolog.

1. To make parsing efficient, remember pieces that have a correct parse so that they don’t have to be re-parsed. It’s still  $O(n^3)$  in worst case to parse, but usually not that bad. We are assuming BNF grammar (term used p. 792, p. 805 Fig. 22.11, Appendix B.1).
2. Point out from p. 805 example that if the grammar only allows 1 non-terminal on the left it will get exponentially large. [Analogy with Prolog allowing only one predicate on the left is an exact analogy.] The solution is to allow grammars which include “context” on the left. A simple context would be to allow the grammar to be **augmented** with variable arguments. See p. 805 Figure 22.11 part 2. The result is a context. The grammar is more powerful, without growing larger and larger every time another distinction is added between categories.

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F. Parsing: We are not going to discuss chart parsing, which is a way to make things efficient. Another suggested final assignment (term project) would be to learn how to do chart parsing and to tell us).

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