

## Language Structure

### 1. Why is language important for Information Science?

communication  
window to thought

systems:

information retrieval  
interfaces  
explanation facilities

text:

abstraction  
report generation  
intelligent tutoring systems  
communication management systems

### 2. What is language?

vs other means of communication  
bee dance  
primate gestures  
music & dance  
programming languages

infinite sets of meanings & utterances  
2nd order infinity / non-enumerable?

many to many mapping  
meaning - utterances

Structure

phonology	sound
syntax	structure
semantics	meaning
pragmatics	use

### 3. Chomsky: Formalization of Linguistics

productivity & regularity  
competence vs. performance

grammar as formalism:

distinguish

grammatical vs. ungrammatical  
(as a compiler does)

linguistic intuitions -> grammar

acceptability

paraphrase / synonymy

ambiguity

lexical

structural

adequacy criteria:

observational    distinguish?

descriptive      describe differences?

explanatory      explain reasons for?

## 4. Syntactic Structure

### Phrase Structure

(psychological evidence)

pause structure

speech errors

Garrett (1990) phonological vs lexical substitutions

reading times

Graf & Torrey (1966) line by line paragraph reading

"transformations" (Chomsky)

active/passive

questions (yes/no, wh-questions)

relative clauses

### Rewrite Rules

terminal and nonterminal symbols

$A \rightarrow B + c$

noun phrase  $\rightarrow$  determiner adjective noun

$\langle \text{integer} \rangle ::= \langle \text{digit} \rangle \mid \langle \text{integer} \rangle \langle \text{digit} \rangle$

### Chomskian Hierarchy

3. regular or finite state grammar

$A \rightarrow B + c$

2. context free

$A \rightarrow \text{anything}$

1. context sensitive

$\alpha + A + \beta \rightarrow \alpha + \text{anything} + \beta$

0. transformational

$\text{anything} \rightarrow \text{anything}$

deep structure vs. surface structure

phrase structure rules (context free)

transformational rules

Parsing:

$A \rightarrow B + c$

NP  $\rightarrow$  det adj noun

NP  $\rightarrow$  NP PP

PP  $\rightarrow$  prep NP

The small bird in the tree  
det adj noun prep det noun  
NP prep NP  
NP PP  
NP

INPUT:

(word the 0 1)

(word small 1 2)

(word bird 2 3)

LEXICAL RULES:

(defrule the

(word the ?b ?e)

$\rightarrow$

(assert (det ?b ?e)))

(defrule small

(word small ?b ?e)

$\rightarrow$

(assert (adj ?b ?e)))

GRAMMAR RULES:

(defrule NP

(det ?b ?m)

(adj ?m ?n)

(noun ?n ?e)

$\rightarrow$

(assert (NP ?b ?e)))

## 5. Relationship between Thought & Language?

Thought = Language:

Behaviorist Proposal

subvocal speech

Smith et al., 1947 curare

Thought depends on Language (linguistic determinism)

Whorf: linguistic relativity

Language depends on Thought

phrase & propositional structure are related

perception → terminology

Rosch, 1973,

Dani color "learning"

preferred word order (SVO etc.)

Greenberg (1963)

SOV 44%

SVO 35%

VSO 19%

VOS 2%

OVS, OSV -

Thinking is independent of Language (modularity)

Fodor: "mentalese"

→ two issues

acquisition, uniqueness question

comprehension

## What does Language Understanding Require?

general knowledge of physical & social world

physical & conversational context

speaker's model of world & conversational goal

## 6. Language Acquisition and Innateness/Uniqueness Issue

brain differentiation

ease of learning

earlier

less conscious

less variability

no evidence of deliberate teaching or reinforcement

developmental regularities

timing

acquisition patterns

critical periods

rules and the past tense

correct irregulars, overgeneralize, correct

Rumelhart & McClelland (1986) PDP model

Pinker & Prince (1988)

data didn't fit

learning didn't fit

meaning (rang vs. ringed)

\* problem of scaling up