

# Language and Computation

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<http://www.birot.hu/courses/2014-LC/>



# Practical matters

- **TA:** Jen Runds (jennifer dot runds AT yale dot edu)
- **Optional sections** for consultation and help in programming.  
Mo 1:30-2:20 and 2:30-3:20, WLH 205 (OK?).  
Starting Mo Jan. 27. Sign up as of tomorrow on Classes V2.
- **Programming section** for a small group w/o programming experience.  
Preferences: LING grad students  $\gg$  LING undergrads  $\gg$  very motivated.  
We 4:30-6:00 (OK? starting next week), probably CLAY lab.  
If interested, send me an email by Mo 01/20.
- **Readings** for Tu 01/21:  
Post-reading: JM Chapt. 1. Pre-reading: JM Ch. 2. Python: H Ch. 1.  
JM Chapt 1 and H Chapt 1 online.



# Language *as* Computation



# Ambiguity

- I saw the man with the telescope.
- I made her duck.
- Sue told Mary to give her the book.
- He ate soup with noodles with a spoon with a friend.
- “Iraqi Head Seeks Arms”. “Two Soviet ships collide, one dies”.
- [thestuffinoz]: The stuff he knows / the stuffy nose.



# Solving ambiguity

- Linguistic knowledge. More linguistic knowledge. Even more linguistic knowledge. . .
- World knowledge.
- Statistics and probability: which is most probable?



# Frequency vs. grammaticality

*I live in New Haven.*

VS.

*I live in New York.*

*He washes the children.*

VS.

*She washes the children.*

# Approaching linguistics

- Interested in *language* or *speech*?
- Interested in *langue* or *parole*?
- in *competence* or *performance*?
- in actual, measurable facts or something more abstract?



# The history of linguistics in a nutshell

Period	aims to understand	language as a ... phenomenon	language belongs to
“Philological” linguistics	text	literary	a book/author
Historical linguistics	history	historical	a nation
Structuralist linguistics	societies and sign systems	social and semiotic	a speaker community
Generative linguistics	brain or mind	biological neurological	an individual or a species

Sociolinguistics. Psycho- and neuro-linguistics.

Nativist vs. emergentist vs. functionalist approaches.

Combination of historical, social and biological aspects.



# Language as computation

- Data structures, a.k.a. representations
- Operations on these representations
- Overall architecture



# Language as computation

## Example: SPE-style phonology

- Data structures, a.k.a. representations:

segments: [a]                      or

$$\begin{bmatrix} + \text{ back} \\ - \text{ round} \\ - \text{ high} \\ + \text{ low} \end{bmatrix}$$

words: [ t a m a :  $\int$  ]                      or                      [  $\epsilon$  p l ]

- Operations on these representations
- Overall architecture

# Language as computation

## Example: SPE-style phonology

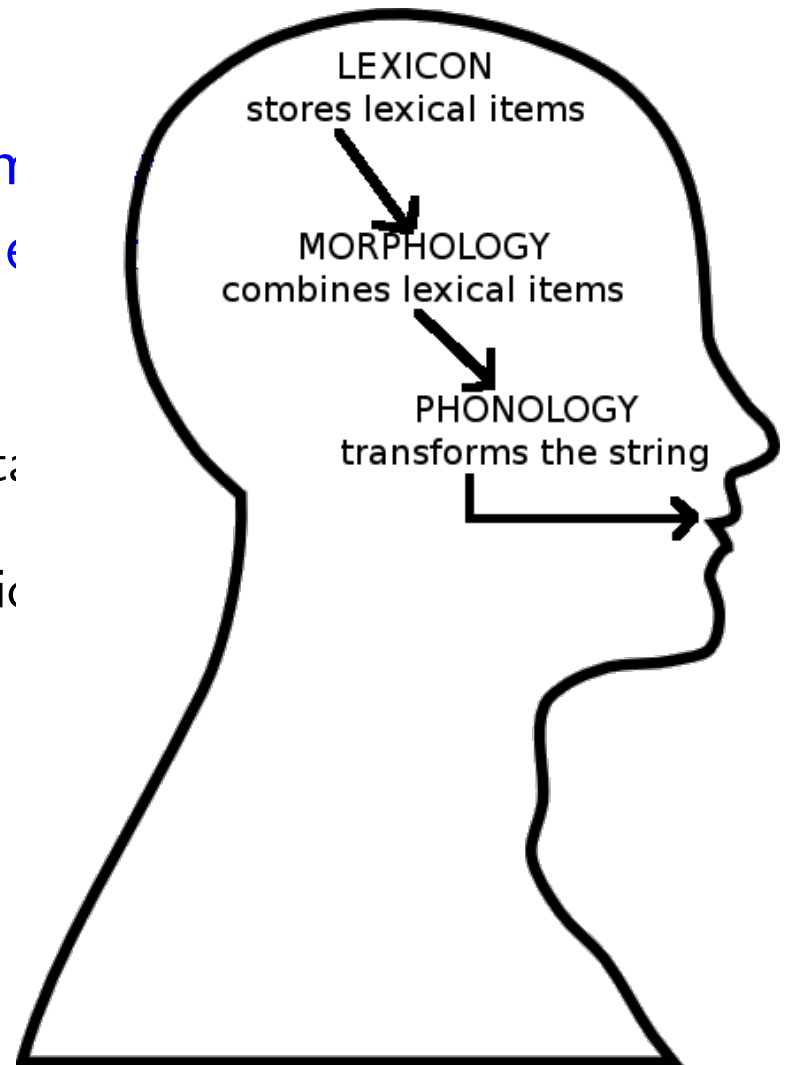
- Data structures, a.k.a. representations
- Operations on these representations: rewrite rules

$$[a] \rightarrow [o] \quad \text{or} \quad \begin{bmatrix} + & \text{back} \\ - & \text{round} \\ - & \text{high} \\ + & \text{low} \end{bmatrix} \rightarrow \begin{bmatrix} + & \text{round} \\ - & \text{low} \end{bmatrix}$$

- Overall architecture

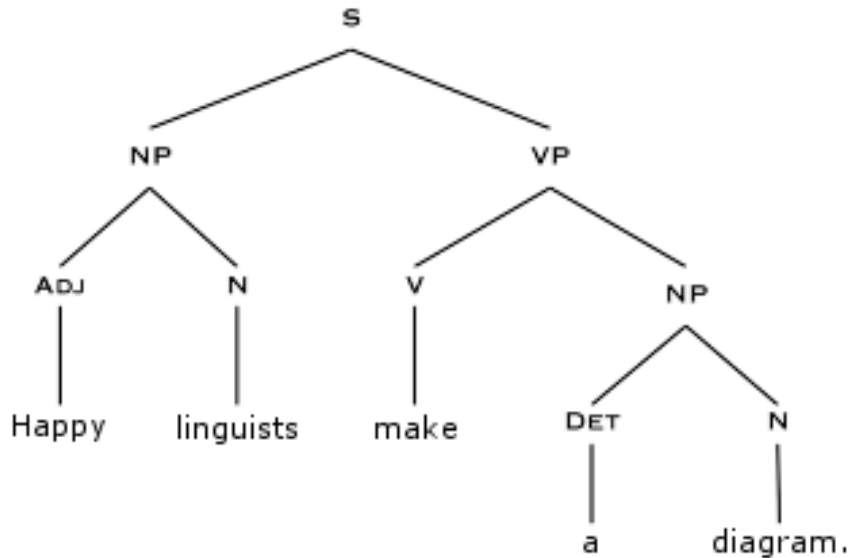
## Language as computation Example: SPE-style

- Data structures, a.k.a. representations
- Operations on these representations
- Overall architecture:



# Language as computation

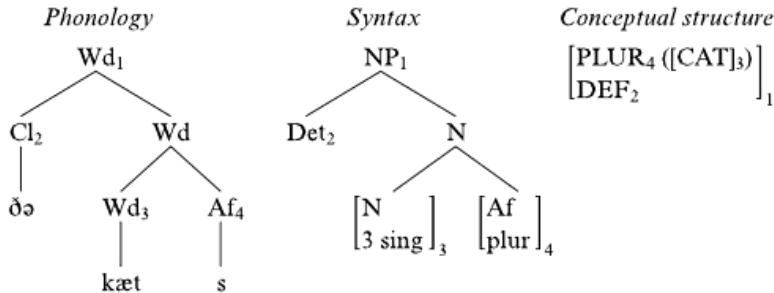
- Data structures, a.k.a. representations



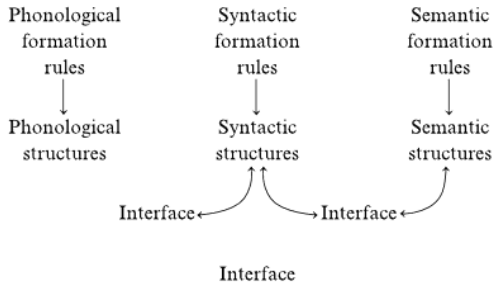
PRED	'make'
SUBJ	PRED 'linguist'
	NUMB Plural
	ADJ 'happy'
OBJ_dir	PRED 'diagram'
	NUMB Singular
	DET —

# Language as computation

- Overall architectures: Jackendoff



**Figure 2.4**  
The structure of *the cats* in the parallel architecture



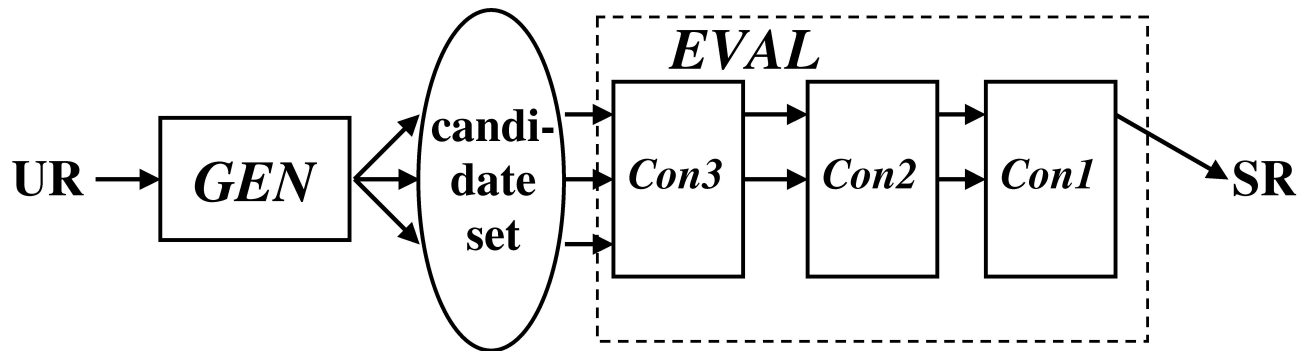
**Figure 2.3**  
The parallel architecture

- (8) a. *Phonological structure*:  
 [Utterance [wd suw]1 [wd gow2 [Aff -z3]4 [wd intuw]5  
 [wd [Cl ðə6] [wd ruwm]7]8]10
- b. *Syntactic structure*:  
 [S [NP N1] [VP [V V2+[pres+3sg]3]4 [PP P5 [NP Det6 N7]8]9]10
- c. *Conceptual structure*:  
 [Event PRES3 [Event GO2 ([Person SUE1], [Path INTO5  
 ([Thing ROOM7; DEF6]8)]9)]10



# Language as computation

- Overall architectures: Optimality Theory



# Language technology as computation

- Data structures, a.k.a. representations: typically bytes, characters and strings.
- Operations on these representations: for example: regular expressions.
- Overall architecture



## Next week:

Our goal: handle words and texts.

- Tu: regular expressions and finite-state automata
- Th: finite-state transducers and edit-distance



## To prepare for next week:

- See previous slides.



See you next week!

