

Levels of Description in Linguistics

Ling499a, Spring 2009

Slide-copying acknowledgment:
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First of all...

- Linguistics as cognitive science
 - Remember Ling240?
- Marr

Marr

- Mind as information processing system
 - Computational theory of mind (Chomsky; Fodor)
- Vision

Information processing

- Representation
 - Formal system for making explicit certain entities or types of information, together with a specification of how the system does this
- Process
 - Operations over representations (arranging representations in certain ways, combining them to construct more complex ones, etc.)
 - Mappings between one type of representation to another

Examples

- *Formal system for making explicit certain entities or types of information, together with a specification of how the system does this:*

{0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

{I, V, X, L, C, D, M}

Constructing an integer:

Constructing an integer:

Processes: *sum and multiplication*

Processes: *sum, grouping and subtraction*

$$37 = (3 \times 10^1) + (7 \times 10^0)$$

Base 10

easy to discover

whether a number is a
power of 10

I

II

III

IIII or IV

IIIII becomes V

IIIIII becomes VI

IIIIIII becomes VII

IIIIIIII becomes VIII or IIX

IIIIIIIII becomes VIIII or IX

IIIIIIIIII becomes X

Also base 10

Hard to do

anything

besides very

simple

arithmetic

Information processing: levels of analysis

To specify an information processing system:

Computational theory

Representation and algorithm

Implementation

*David Marr, Vision
Tomaso Poggio*

Addition

To specify an information processing system:

Computational theory

The theory of arithmetic

Representation and algorithm

Arabic or Roman numerals? Decimal or binary?
Add and carry? Group and count?

Implementation

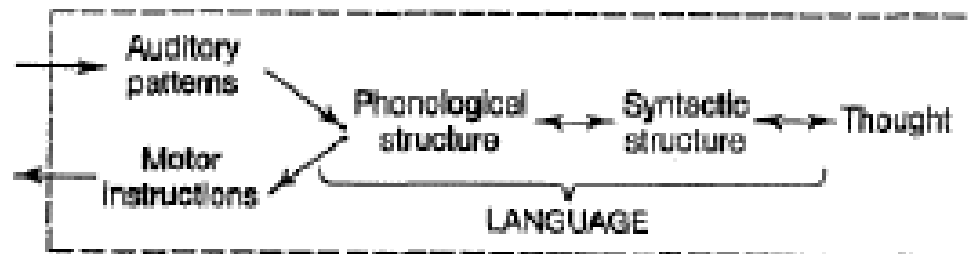
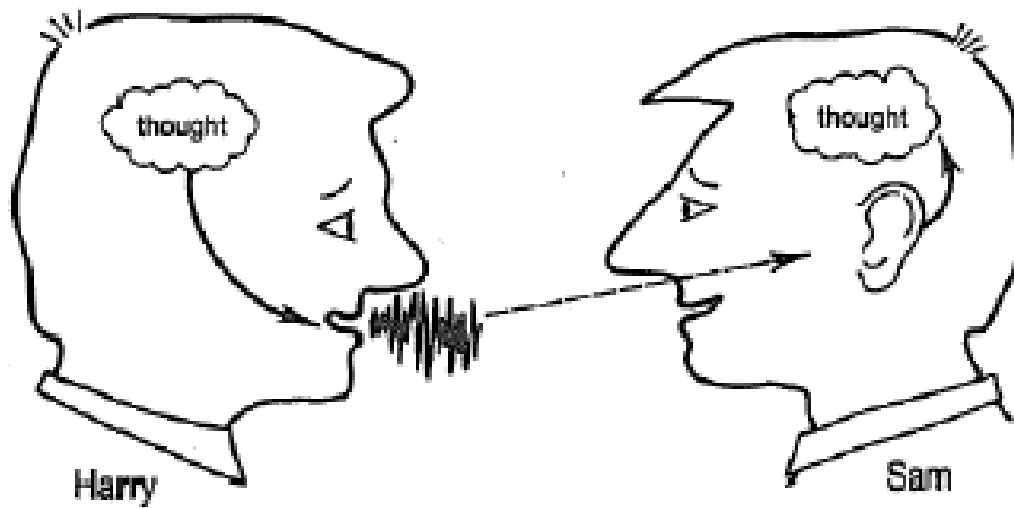
An abacus; pencil, paper and lookup tables;
A digital circuit

What about language?

Linguistics

- Theoretical linguistics
 - Syntax, Phonology, Semantics, etc.
- Psycholinguistics?
 - How do we speak, understand and acquire language?
- Neurolinguistics?
 - Brain and language

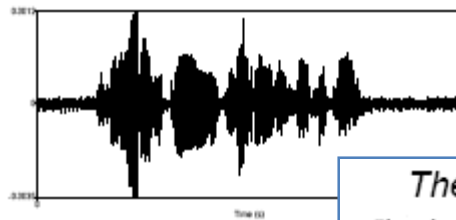
Language



From Jackendoff (1994)

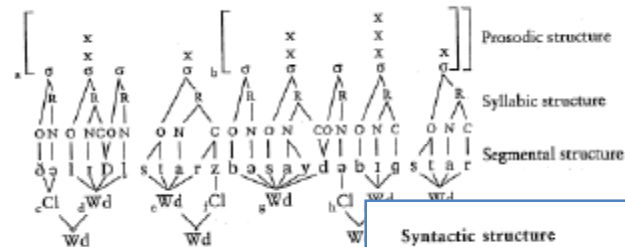
Linguistic representations

The little star is beside the big star
 The little star is beside the big star

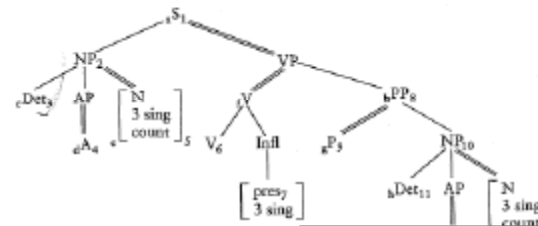


The little star is beside the big star

Phonological structure



Syntactic structure



Semantic/conceptual structure



Spatial structure



A quote from Fromkin et al intro-ling textbook:

“Psycholinguistics is the area of linguistics that is concerned with **linguistic performance** – how we use our linguistic competence – in speech (or sign) production and comprehension. The human brain is able not only to **acquire** and store the mental lexicon and grammar, but also to access that linguistic storehouse to ***speak and understand language in real time***. (Emphasis added by me)

Using Marr's levels

Computational theory

What is the problem:

Mediation between "sound" and "meaning"

Different levels (phonology and syntax)

Theoretical Linguistics

Representation and Algorithm

How it is done:

Processes of online comprehension and production

Psycholinguistics

Implementation

What it is done *with*:

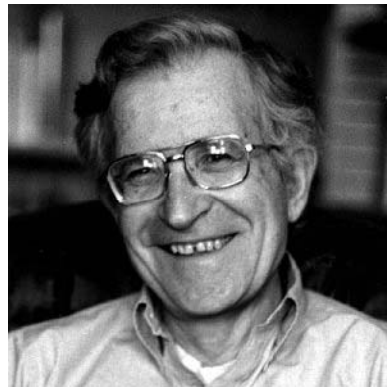
Brain

Neurolinguistics

Competence vs. Performance

- ...is this what Chomsky intended?

“It has sometimes been argued that linguistic theory must meet the empirical condition that it account for the ease and rapidity of parsing. But parsing does not, in fact, have these properties. [...] In general, it is not the case that language is readily usable or ‘designed for use.’” (Chomsky & Lasnik, 1993, p. 18)



Chomsky (1965)

- “Linguistic theory is concerned primarily with an ideal speaker-listener [...] who knows its language perfectly, and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention, and interest, and errors (random or characteristic) in applying his knowledge of language in actual performance. [...]

We thus make a fundamental distinction between *competence* (the speaker-hearer’s knowledge of his language) and *performance* (the actual use of language in concrete situations). Only under the idealization set forth in the preceding paragraph is performance a direct reflection of competence.” (pp. 3-4)

- “When we say that a sentence has a certain derivation with respect to a particular generative grammar, we say nothing about how the speaker or hearer might proceed, in some practical or efficient way, to construct such a derivation. These questions belong to the theory of language use - the theory of performance.” (p. 9)

Standard View

$$\begin{array}{r} 324 \\ 697+ \\ \hline ? \end{array}$$

$$217 \times 32 = ?$$

arithmetic

Standard View

specialized algorithm

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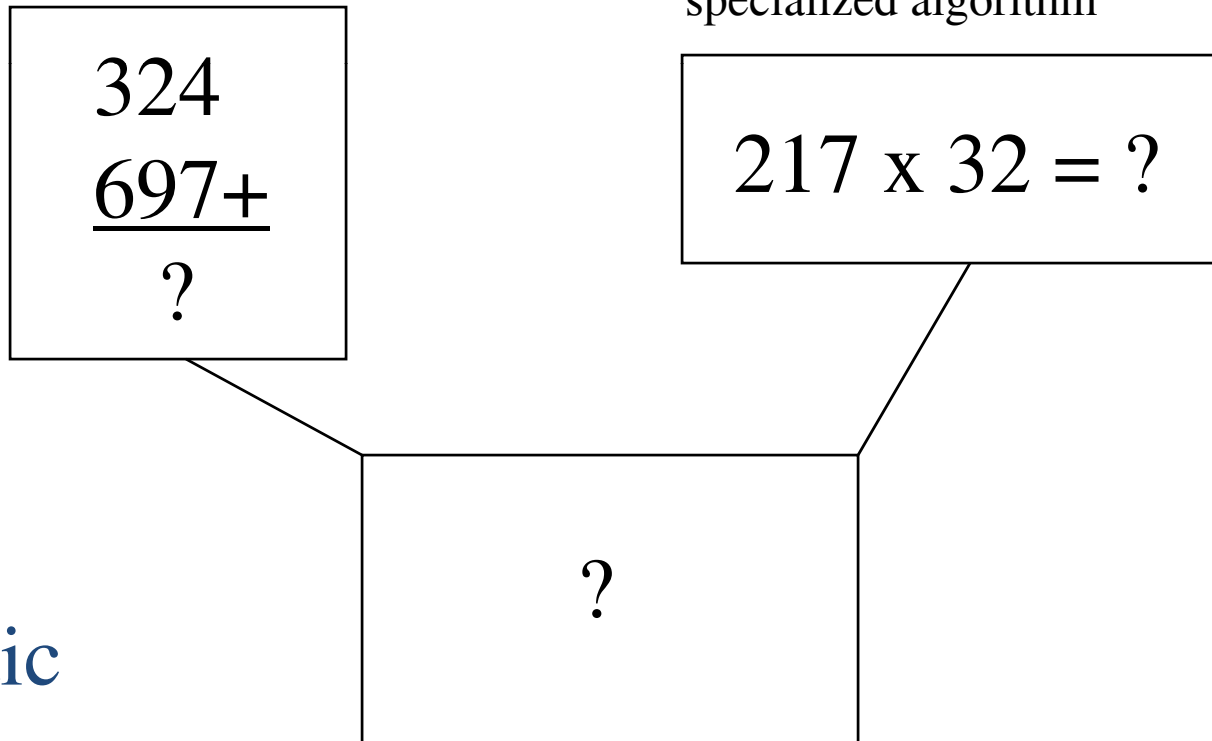
specialized algorithm

$$217 \times 32 = ?$$

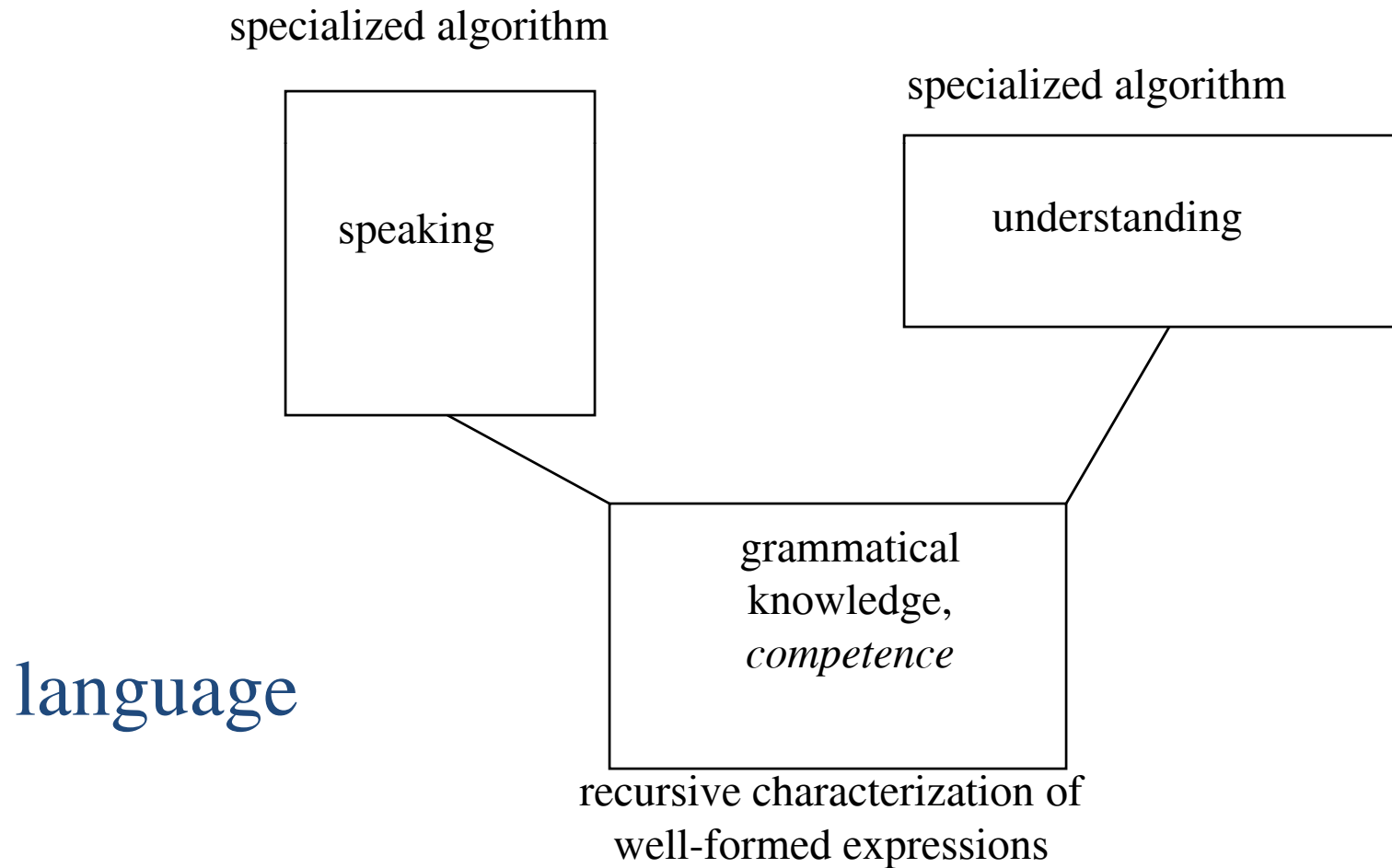
arithmetic

$$?$$

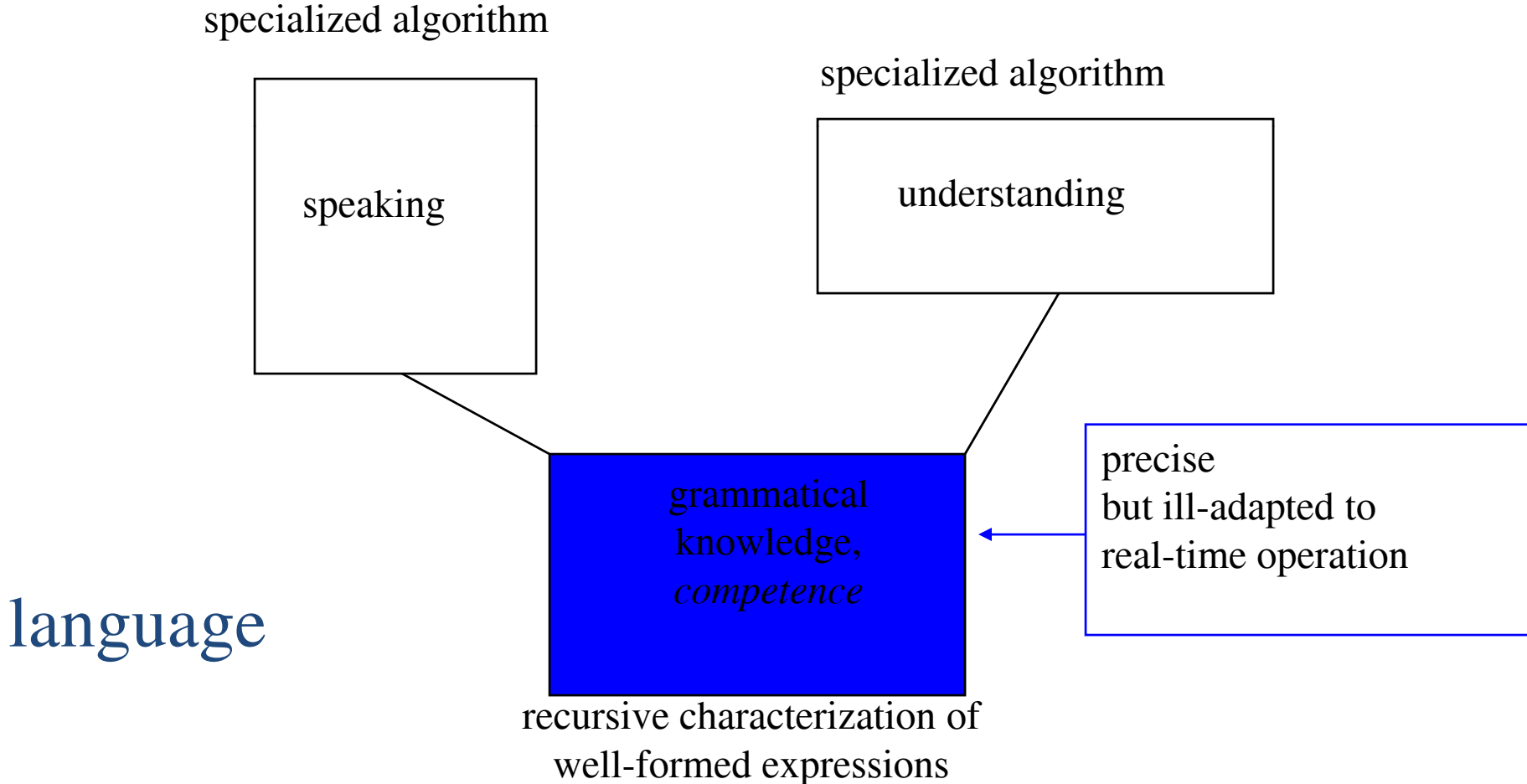
something deeper



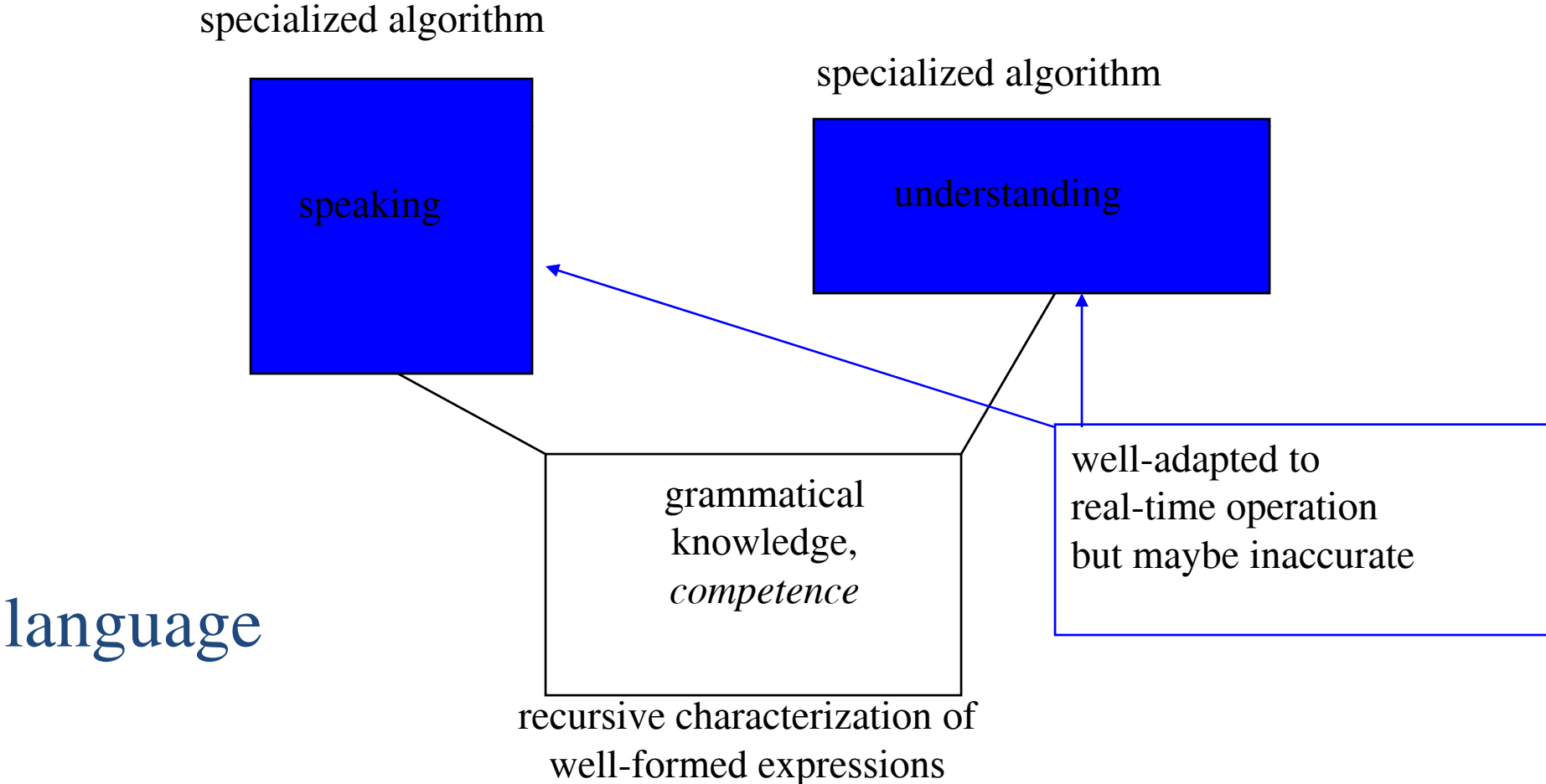
Standard View



Standard View



Standard View



One unified system



Representation and algorithm

What are the 'routines' for understanding/producing language?

???

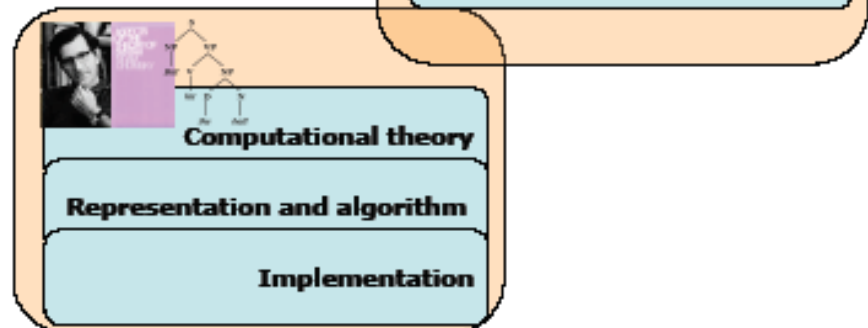
How are they related to the well-formedness conditions/derivations specified by the computational theory?

Implementation

Or not ...

Performance (use)

Competence (grammaticality)



Next week

- Syntax of wh-movement (read Haegeman chapter, which is to be uploaded later today)
- Lab 1 will be assigned on Tuesday!
- Presentation assignment (the 1st round)