



# Functional Generative Description (FGD)

Markéta Lopatková

Institute of Formal and Applied Linguistics, MFF UK

[lopatkova@ufal.mff.cuni.cz](mailto:lopatkova@ufal.mff.cuni.cz)

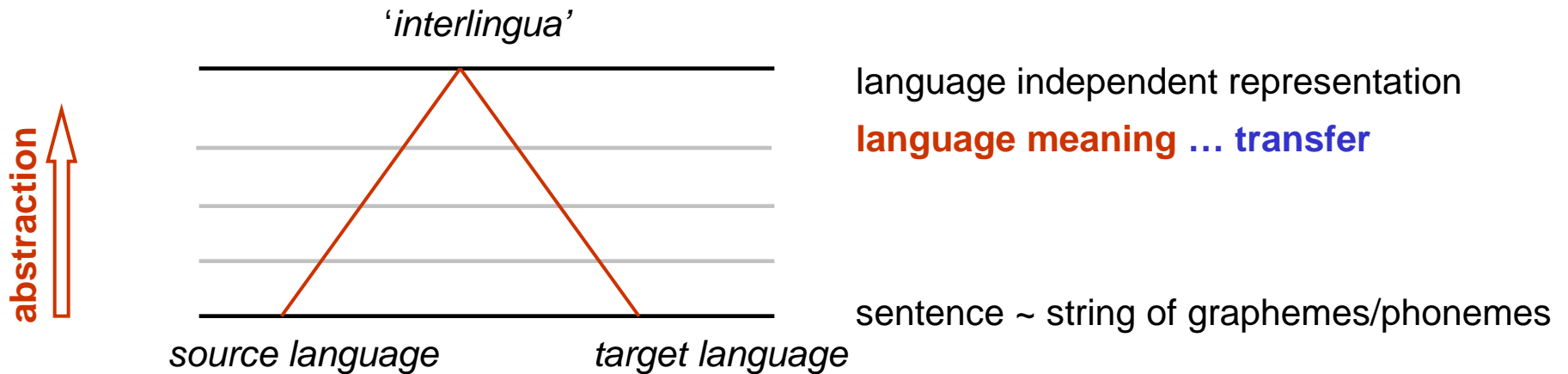
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# Basic characteristics of FGD



- motivation: machine translation



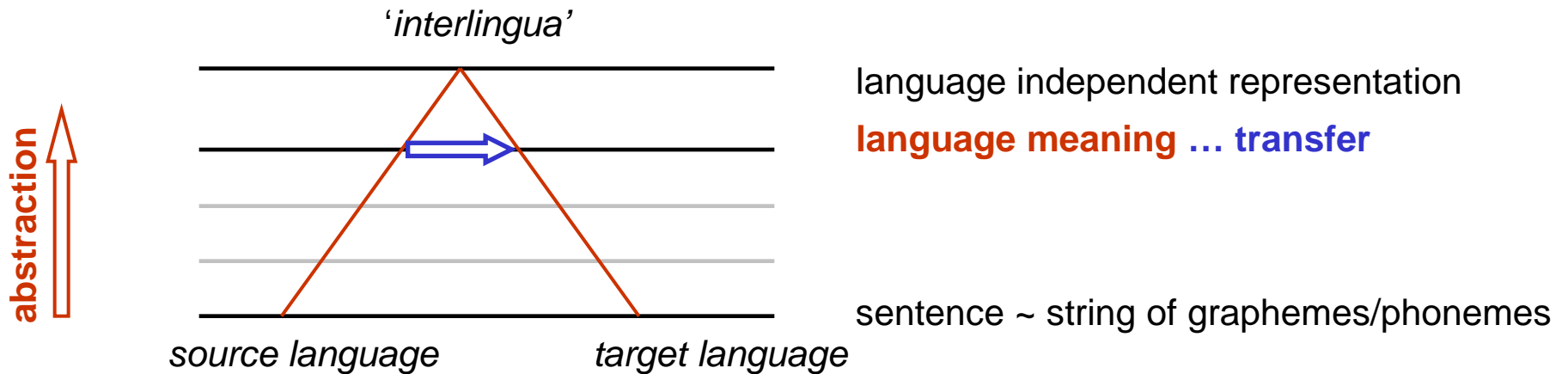
- Petr Sgall (1967) *Generativní popis jazyka a česká deklinace*. Academia, Praha
- since 1970s ... together with Eva Hajičová, Jarmila Panevová
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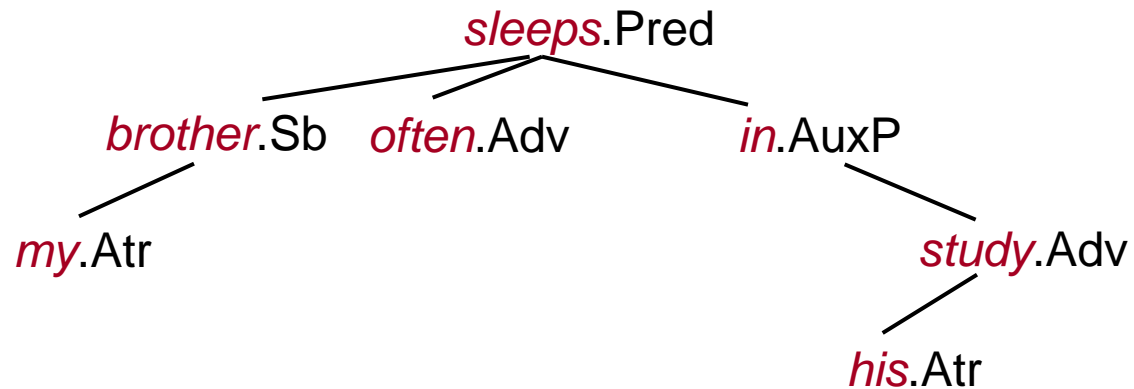
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# Basic characteristics of FGD (cont.)



'classical' version of FGD:

- dependency framework
  - formal description
  - suitable mathematical formalism



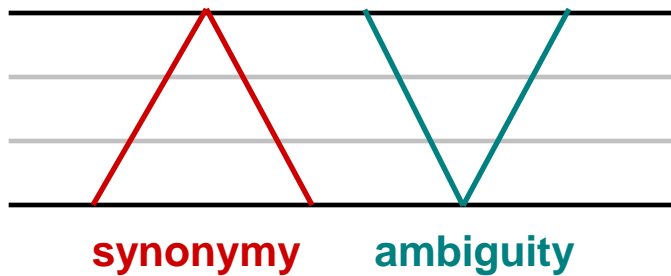
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# Basic characteristics of FGD (cont.)



'classical' version of FGD:

- dependency framework
- stratificational approach



language meaning ~ **function**

string of graphemes/phonemes ~ **form**

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# Basic characteristics of FGD (cont.)



'classical' version of FGD:

- dependency framework
- stratificational approach
- relation between a form and its function  
/ a function and its form



*functional*

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# Basic characteristics of FGD (cont.)



'classical' version of FGD:

- dependency framework
- stratificational approach
- relation between a form and its function  
/ a function and its form
- language meaning (not cognitive content)
- *generative* vs. analytical



*functional*

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# Basic characteristics of FGD (cont.)



- tradition of Prague Linguistic Circle
  - structural school, since 1926
  - Mathesius, Trnka, Havránek, Mukařovský, Jakobson, Trubeckoj, Karcevskij, ...
- language as a system ~ langue  
vs. individual utterances ~ parole
- stress on testable criteria for distinguishing lang. phenomena
- higher layers of language description (syntax)
- topic focus articulation as a part of language meaning



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# Two components of FGD



- generative component
  - ~ to define all formally correct meaning representations (of possible sentences of a given language)
    - formalism: 1) phrase rules, phrase structure trees + functors  
2) dependency trees
    - push-down automaton
- translation component
  - ~ translating meaning representations to lower layers
    - sequence of push-down transducers plus finite-state automaton

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# Main pillars of FGD



- system of layers
- valency theory
- topic focus articulation
- anaphora / coreference

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# System of layers in FGD



**meaning**

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deep / underlying syntax  
tectogrammar

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surface syntax

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morphematics

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morphonology

**expression**

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phonology/phonetics

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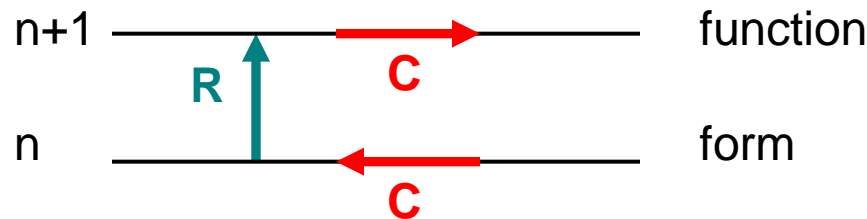
# System of layers in FGD (cont.)



sentence ... full representation on each layer of description

**each layer** ~ set of descriptions for all possible sentences

- finite set of elementary units
- finite set of operations and relations → set of complex units
- finite set of relations between sentence representations on a particular layer and its representations on adjacent layers

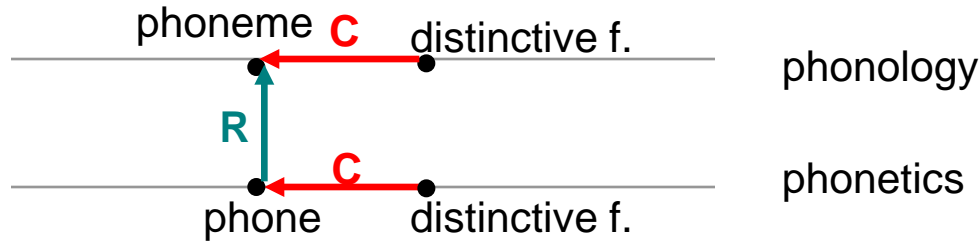


**type C relations (composition):** elementary units constitute complex units  
i.e., relations between units of the same layer

**type R relations (representation):** form-function relation  
i.e., relation between adjacent layers

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# System of layers in FGD (cont.)



## layer of phonetics

distinctive features ... elementary units

phones (~ a speech sound) ... complex units

suprasegmental units ... prosody, intonation

## layer of phonology

distinctive features ... elementary units

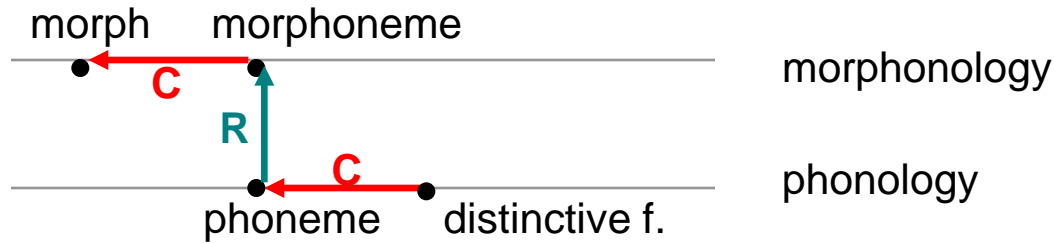
phonemes (~ 'smallest' units that distinguish meaning) ... complex units

asymmetry ... allophones ~ variants of a single phoneme

language dependent (sing vs. sin)

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# System of layers in FGD (cont.)



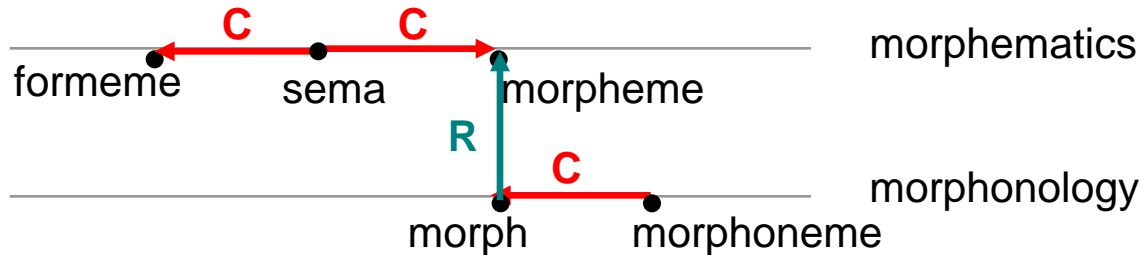
## layer of morphonology

morphoneme ~ set of phoneme variants e.g.  $k/c/\check{c}/.k$  in "matka"

morph ~ string of morphonemes

lexical variants (*matk*, *matc*, *matč*, *mat.k*) ... 4 allomorphs  
 $mat(k/c/\check{c}/.k)$  1 morph

# System of layers in FGD (cont.)



## layer of morphemematics

morpheme ~ the smallest component that has semantic meaning

- lexical morpheme

- roots

- e.g. lex. morpheme for *matka* consists of 4 allomorphs (*matk*, *matc*, *matč*, *mat.k*) ;  
for *to write* (*writ*, *wrot*); for *leaf* (*leaf*, *leav*)

- derivational morphemes (affixes: prefixes, infixes, suffixes, ... )

- grammatical morpheme

- inflectional suffixes e.g. Cz: case suffixes, Eng: plural -s, past tense -ed

- sema

- formeme: sequence of morphs realizing a single tagmeme / sentence member

- lexical f., case f. (i.e., prep+case), conjunction formemes (i.e., conj+verb mood)

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# Two layers of syntax in FGD



tree-based dependency structure

- nodes for tagmemes or sememes (complex symbols)
- edges labeled with a type of a respective syntactic relation





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# Two layers of syntax in FGD

tree-based dependency structure

- nodes for tagmemes or sememes (complex symbols)
- edges labeled with a type of a respective syntactic relation

## layer of surface syntax

~ structure of sentence members / *tagmemes*  
incl. lexical and morphological information

3 types of elementary units:

- lexical: units from a dictionary
- morphological: set of morphological features  
(a pair of) trousers ... sema - plural
- syntactic: sentence members / tagmemes  
subject, object, attribute, adverbial, complement,...

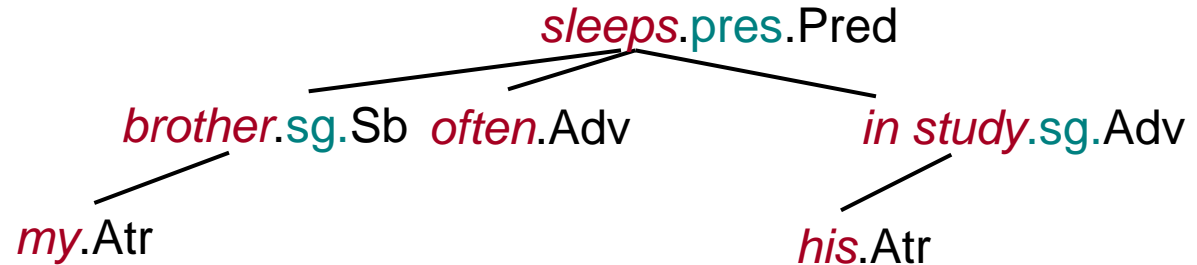
surface word order ... linear ordering of tree nodes

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# The layer of surface syntax

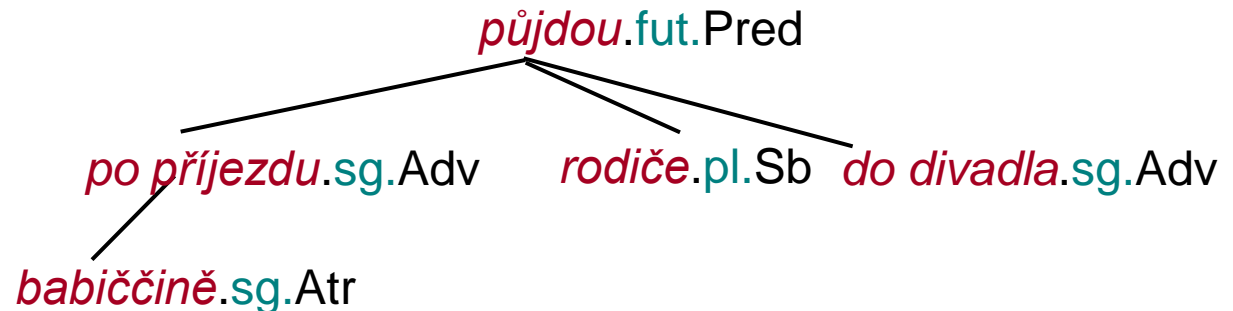


*My brother often sleeps in his study.*



*Po babiččině příjezdu půjdou rodiče do divadla.*

[After grandma's arrival the parents will go to the theatre.]



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# The layer of deep syntax



~ meaning of a sentence:

***semantemes***: lexical (autosemantic) words, their lexical and morphological features and mutual relations

terminology: deep / underlying / tectogrammatical representation (TR)

3 basic types of elementary units:

- lexical: units from a (tectogrammatical) dictionary
- morphological: ***grammatemes***

*meaning* of individual morphological categories

(a pair of) trousers ... singular

*denominating* (*pojmenovávací*)

vs. *correlating* (*usouvztažňující*) categories

- syntactic: types of relation, ***functors*** and ***subfunctors***

Actor, Patient, Addressee, ... local, temporal modifications ...

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# The layer of deep syntax



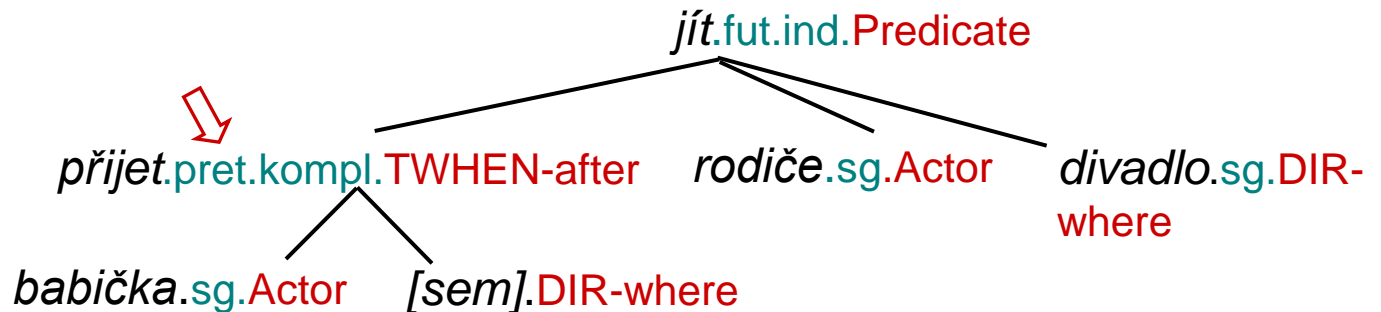
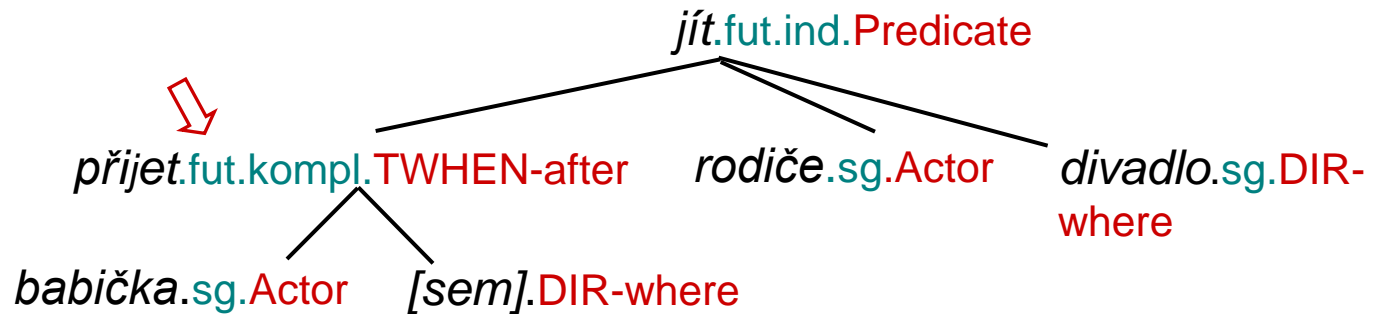
- deep word order
  - increasing communicative dynamism:  
word order reflects "relative degree of importance in comparison with other expressions in the sentence [...]"
  - topic focus articulation
- condition of projectivity !!!

# The layer of deep syntax



*Po babiččině příjezdu půjdou rodiče do divadla.*

[After grandma's arrival the parents will go to the theatre.]



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# The layers of deep and surface syntax



- different sets of elementary units

- 'morphological' vs. tectogrammatical lemma
- morphological categories vs. grammatemes
- surface sentence members vs. functors



- sentence members / *tagmemes* vs. *semantemes*

- only autosemantic / lexical words at TR

- modal verbs

*Peter wants to attend the concert.* [to attend + volitive]

*Charles has to pass the exam.* [to pass + debitive]

- nominalization

*After grandma's arrival ...* → [to arrive]

- active / passive verbs → [active form]

*Tato krásná kniha byla vydána nakladatelstvím Albatros.*

[This beautiful book was published by the Albatros publishing house.]

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# The layers of deep and surface syntax



- different sets of elementary units

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- sentence members / *tagmemes* vs. *semantemes*

- only autosemantic / lexical words at TR
- completeness of the representation – (surface) ellipses are restored omitted surface subject (Czech: pro-drop language):

Czech: *Vidíš bratra? Vidím. Přichází.*

→ [Ty] vidíš bratra? [Já] vidím [ho]. [On] přichází [sem].

Russian: *Ты видел брата? Вижу [его]. Идём.*

Spanish: *¿Ves este tronco? [(Do) you see this log? ]*

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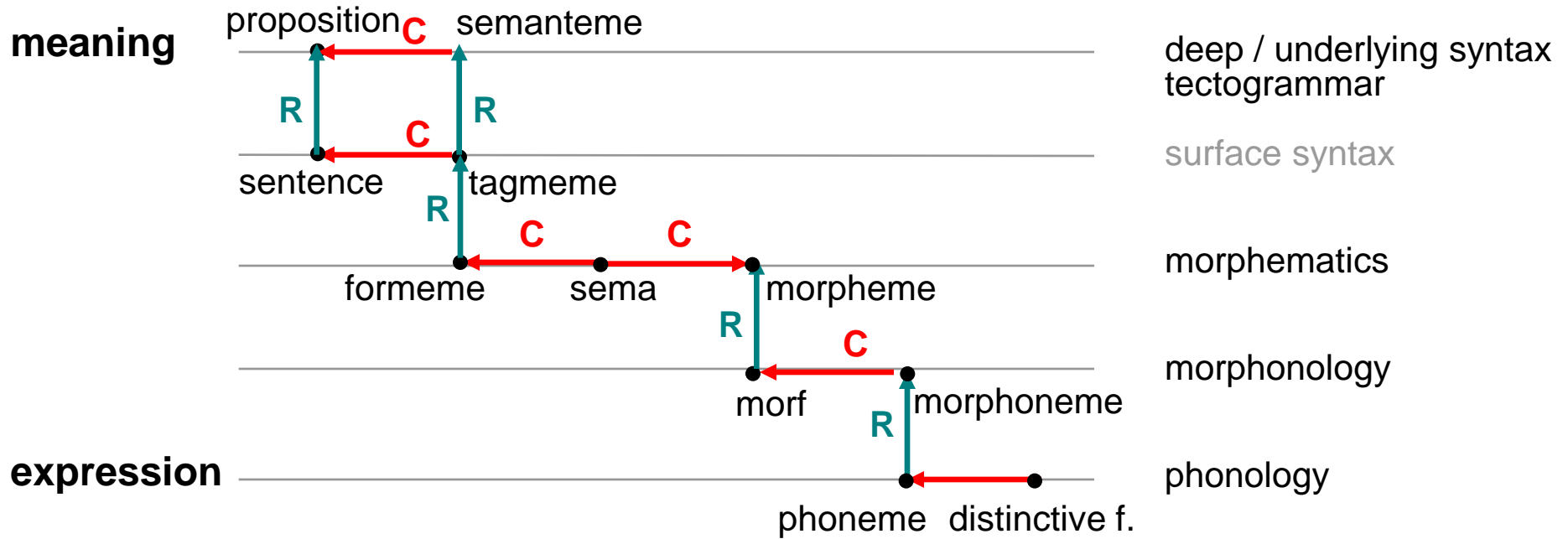
# The layers of deep and surface syntax



- different sets of elementary units
  - 'morphological' vs. tectogrammatical lemma
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- ➡
- sentence members / *tagmemes* vs. *semantemes*
  - only autosemantic / lexical words at TR
  - completeness of the representation – (surface) ellipses are restored
- surface vs. deep word order:
  - TR: projective trees
  - increasing communicative dynamism

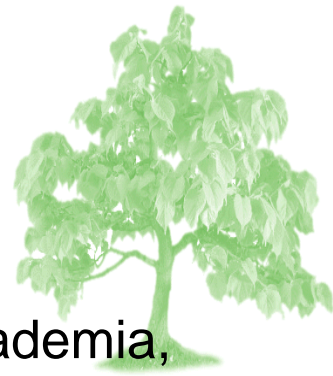


# System of layers in FGD



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# References



- Sgall, P. (1967) *Generativní popis jazyka a česká deklinace*. Academia, Praha
- Sgall, P., Hajičová, E., Panevová, J. (1986) *The Meaning of the Sentence in Its Semantic and Pragmatic Aspects*. Reidel, Dordrecht.
- Sgall, P. a kol. (1986) *Úvod do syntaxe a sémantiky*. Academia, Praha
- Hajičová, E., Panevová, J., Sgall, P. (2002) *Úvod do teoretické a počítačové lingvistiky*, sv. I. Karolinum, Praha.
- Petkevič, V. (1995) A New Formal Specification of Underlying Structure. *Theoretical Linguistics* Vol.21, No.1.
- PDT guide <http://ufal.mff.cuni.cz/pdt2.0/>
- PDT documentation