Functional Generative Description (FGD)
System of layers; lower layers

Markéta Lopatková
Institute of Formal and Applied Linguistics, MFF UK
lopatkova@ufal.mff.cuni.cz
Basic characteristics of FGD

• motivation: machine translation

\[
\text{source language} \rightarrow \text{‘interlingua’} \rightarrow \text{target language}
\]

\[
\text{language independent representation}
\]

sentence ~ string of graphemes/phonemes

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

• motivation: machine translation

\[ \text{‘interlingua’} \]

language independent representation

language meaning … transfer

sentence ~ string of graphemes/phonemes

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

'classical' version of FGD:

- dependency framework
  - formal description
  - suitable mathematical formalism

Diagram:

- sleeps.Pred
  - brother.Sb
  - often.Adv
  - in.AuxP
    - my.Atr
    - study.Adv
      - his.Atr
Basic characteristics of FGD (cont.)

'classical' version of FGD:
• dependency framework
• stratificational approach

language meaning ~ function

string of graphemes/phonemes ~ form

synonymy  ambiguity
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
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
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 ~ parol
- stress on testable criteria for distinguishing lang. phenomena
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 ~ parol

- stress on testable criteria for distinguishing lang. phenomena

- higher layers of language description (syntax)

- topic focus articulation as a part of language meaning
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
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
Main pillars of FGD

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

**meaning**
- deep / underlying syntax
tectogrammar
- surface syntax
- morphematics
- morphonology

**expression**
- phonology/phonetics

---

PDT – FGD  
Lopatková
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 \(\rightarrow\) set of complex units
  • finite set of relations between sentence representations
    on a particular layer and its representations on adjacent layers
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

\[ \begin{align*}
  n+1 & \quad \text{function} \\
  n & \quad \text{form}
\end{align*} \]

\[ \begin{align*}
  R & \quad C \\
  C & \quad C
\end{align*} \]

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
System of layers in FGD (cont.)

Layer of phonetics
- **distinctive features** ... elementary units
- **phones** (~ a speech sound) ... complex units
- suprasegmental units ... prosody, intonation

Diagram:
- phoneme
- distinctive f.
- phone
- distinctive f.

C - phonology
R - phonetics
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)
System of layers in FGD (cont.)

layer of morphonology
mphoneme ~ set of phoneme variants  e.g. k|c|č|.k in "matka"
oo|ee in "foot"
layer of morphonology

- morphoneme ~ set of phoneme variants
  - e.g. $k|c|\check{c}|.k$ in "matka"
- morph ~ string of morphonemes
  - lexical variants $(matk, matc, mat\check{c}, mat.k) \ldots$ 4 allomorphs
    - $mat(k|c|\check{c}|.k)$ 1 morph
  - lexical variants $(foot, feet) \ldots$ 2 allomorphs
    - $f(oo|ee)t$ 1 morph
layer of morphematics

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, … )
    *il-* (as in *illegal*), *non-* (as in *nonproblematic*)
    *-ly* (as in *legally*), *-ess* (as in *actress*)
layer of morphematics

morpheme ~ the smallest component that has semantic meaning

- **lexical morpheme**
- **grammatical morpheme**
  - inflectional affixes  e.g. Cz: suffixes
    - nouns: case, gender, number, …
    - verbs: gender, number, tense, voice,
  - Eng: suffixes
    - nouns: plural -s
    - verbs: past tense -ed, continuous –ing
System of layers in FGD (cont.)

layer of morphematics

morpheme ~ the smallest component that has semantic meaning

• lexical morpheme

• grammatical morpheme
  • inflectional affixes  e.g. Cz: suffixes
    nouns: case, gender, number, …
    verbs: gender, number, tense, voice,
    Eng: suffixes
    nouns: plural -s
    verbs: past tense -ed, continuous –ing
  e.g. matka + a
  boy + s
  koup + il
  play + ed

• sema … a combination of grammatical morphemes that characterize
  a lexical morpheme (or strings of lexical morphemes)
System of layers in FGD (cont.)

layer of morphematics

morpheme ~ the smallest component that has semantic meaning
• lexical morpheme
• grammatical morpheme
• 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)

Cz:  vysok+á škol+a; lamp+a; na+lavic+i; chod+i; bud+e+chod+it
Eng: white-collar; lamp; on+ table; walk+s; will+be+walk+ing
System of layers in FGD (cont.)

morpheme ~ the smallest component that has semantic meaning

Czech … (inflection language):

*nejneobhospodařovatelnější*

*nej-ne- ob-hospod-ař-ova-teln-ějš - í*

root

most-non-`cultivate` - [iter]- [adj] - [super]-[sg+nom+fem | sg+acc+neutr | … pl+voc+masc]

23 combinations ("meanings")

grammatical morphemes
System of layers in FGD (cont.)

morpheme ~ the smallest component that has semantic meaning

Hungarian (agglutinative language):

- fi-ú  boy
- fi-a  his/her son
- fi-á-é  his/her son's (singular object)
- fi-á-é-i  his/her son's (plural object)
- fi-a-i  his/her sons
- fi-a-i-é  his/her sons' (singular object)
- fi-a-i-é-i  his/her sons' (plural object)

Turkish (agglutinative language):

- Dilbilimcileştiremeyebileceklerimizdenmiydiniz?
  Were you one of those whom we would not be able to transform into a linguist?

Sibel Ciddi (2013)
System of layers in FGD (cont.)

Example of the Arabic MorphoTrees hierarchy

singular usage; individuation  | individual; unit/individuals
N--------2I N--------2R N--------2R
References

• Sgall, P. (1967) *Generativní popis jazyka a česká deklinace*. Academia, Praha
• Sgall, P. a kol. (1986) *Úvod do syntaxe a sémantiky*. Academia, Praha