

# Mathematising Linguistics - The Case of Transformational Theory

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Thomas Meier  
Doctoral Fellow  
Munich Center for Mathematical Philosophy  
LMU Munich

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## Aim of this talk:

- Outline the phase of theory change from Bloomfield to Harris
- Discuss Harris' formalization of syntax and his introduction of transformational theory as a case of mathematization.

# Content

- 1 Bloomfield's Structural Linguistics
- 2 Bloomfield on Syntax
- 3 Harris' Transformational Theory: Progress in Linguistics
- 4 Summary

# 1. Bloomfield's Structural Linguistics

## Main work:

- *An Introduction to the Study of Language* (1914).
- *A Set of Postulates for the Science of Language* (1926).
- **Language** (1933) ←
- *Menomini Morphophonemics* (1939).

## The central claims of Bloomfield's theory:

- Language manifests through **acts of speech**. Such acts are concrete actions of utterance. Languages are always spoken in **linguistic communities**.
- Linguistic communities are groups of speakers. Their utterances are alike or at least partially alike. This is a necessary feature of such communities.
- Recurrent sound features are **forms**. These forms receive meaning through recurrent stimulus-response-features.

- There is no semantics grounded on mental principles. The only way to study linguistic meaning is by behaviorist psychology (scientific view - in 1933).
- Not further divisible forms are *morphemes* (e.g. *-hood*, *-ness*, etc.).
- There exist *free* and *bound* forms. A minimal free form is a word. A non-minimal free form is a phrase. A maximal form is a sentence.

- The minimal free forms (the words) of a language are finite in its number.
- A *phoneme* is a minimal unit of sound. The morphemes of a language can be divided into smaller, meaningless phonemes.
- The phonemes of a language change through time. Changes in the phonemes of a language (phonological alternation) arise by the arrangement of certain phonemes, which influence on each other.

- Bloomfield's theory focuses on the linguistic disciplines of phonology and morphology.
- There is no strong semantic theory. For Bloomfield, Behaviorism solves all semantic questions.
- The structural linguist like Bloomfield will start with phonology, develop morphology out of it, then develop a syntax out of it.
- The notion of linguistic form is central in Bloomfield's theory.



## 2. Bloomfield on Syntax

- *Word.*

(1926: 156) *A minimum free form is a word.*

- *Phrase.*

(1926: 156) *A non-minimum free form is a phrase* (e.g. the noun phrase *The dog*).

- *Sentence*

(1926: 158) *A maximum construction in any utterance is a sentence.*

**Bloomfield already mentions what is systematized later by Harris: That certain morpheme-classes correctly combined build up a grammatical sentence.**

- *Construction*

(1926: 158) *Each position in a construction can be filled only by certain forms.*

Example: *The tree is old. - The \_ is old.*

In the empty slot, only certain classes of morphemes (or forms) can occur. In this case, certain noun-classes.

- Bloomfield on *Substitution*:

(1933: 247) *A substitute is a linguistic form or grammatical feature which, under certain conventional circumstances, replaces any one of a class of linguistic forms . . .*

*. . . thus, in English, the substitute 'I' replaces any singular-number substantive expression, provided that this substantive expression denotes the speaker of the utterance in which the substitute is used.*

*. . . the substitute replaces only forms of a certain class, which we may call the domain of the substitute; thus, the domain of the substitute 'I' is the English form-class of substantive expressions.*

### 3. Harris' Transformational Theory: Progress in Linguistics

- Harris developed his *Discourse Analysis* in 1952. His first systematic exposal has been published as *Co-occurrence and Transformation in Linguistic Structure* in 1957.
- Harris primarily searched for a criteria of differentiation between sentences.
- Before him, the analysis of language had been carried out from the most elementary level of phonemes up to the level of sentences.

- Harris wanted to go further than Bloomfield and searched for a systematization of sentence-types.
- He developed a method that enabled linguists to describe how sentences are built and changed from one mood-type into another, like active - passive. These changes he called *transformations*.
- He introduced a formalism to label different types of phrases: noun phrases (N), verbal phrases (V), prepositional phrases (P),  $\leftrightarrow$ , etc.

# Kernel Sentences

- 1957, 335: *The kernel is the set of elementary sentences and combiners, such that all sentences of the language are obtained from one or more kernel sentences (with combiners) by means of one or more transformations.*

Example of an elementary sentence: *John saw Jill.*

- 1957, 339: *Our picture of a language, then, includes a finite number of actual kernel sentences, all cast in a small number of sentence structures built out of a few morpheme classes by means of a few constructional rules; a set of combining and introducing elements; and a set of elementary transformations . . . .*

Sentences like:

*John saw Jill, The cat sits on the mat, The tree is old, etc..*

- Example: The kernel sentence:

*John saw Jill*, in active is obtained from the passive

*Jill was seen by John*, through a transformation.

- Harris' formalism in this case:  $N_1 V N_2 \leftrightarrow N_2 V^* N_1$ .



## Co-occurrence

- For Harris, morphemes can be grouped into classes (e.g. the class of suffix-morphemes *-hood*, etc.). The members of a class have similar sets of co-occurents (here: *neighbour-*, *false-*, *likeli-*, etc. Each class occurs with specific other classes to make a sentence structure.
- Furthermore, certain sequences of classes build up sentences. These sequences are products of a small number of elementary class sequences (constructions) which are combined in certain ways.
- *TNPV* (= The risk of crisis vanished) results from the more elementary class sequences *TNV* and *NPN*.

# Immediate Constituent Analysis - Phrase Structure Trees

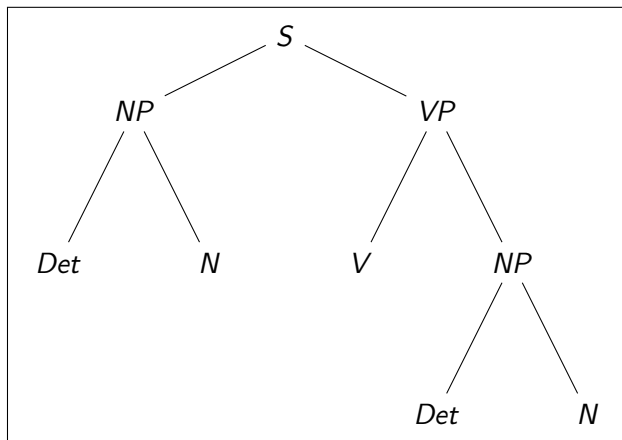


Figure: Analysis of the sentence: *The student reads a book*

# On Chomsky

- The notions of *Deep Structure* and *Surface Structure* were introduced later (with Chomsky, 1965).
- Chomsky's proposals imply more controversial views on the relation between semantics and syntax.
- For Chomsky, every sentence had a deep structure and a surface structure. In the beginning, Chomsky claimed that deep structure determined meaning, etc.

- For the 1965 Chomsky, even interrogative sentences like

*Which car did John wash?*

had a deep structure, where their real meaning was

*John washed that car.*

## 4. Summary

- Bloomfield systematized an important part of syntactic theory.
- He already introduced that certain linguistic forms can be grouped into classes.
- Such form-classes cannot be substituted by any other form-class.

- Harris took Bloomfield's ideas on syntax and developed them further.
- By introducing his formalism, Harris took a first step towards a mathematization.
- This made it possible to give linguistic theory a stronger explanatory power and certainly helped linguistics to become a *mature* science.

Thank you!

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