

A logical Reconstruction of Leonard Bloomfield's Linguistic Theory

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Abstract

In this work we present a logical reconstruction of Leonard Bloomfield's theory of structural linguistics. First, the central notions of this theory are analyzed and discussed. In the following section, a reconstruction with the so-called *structuralist* approach in the philosophy of science is presented. After defining the general framework of Bloomfield's theory, questions of lawlikeness and theoretical terms will be discussed. In a further step, this work aims to contribute to the discussion of theory change and scientific realism, applied to linguistic theory. After the reconstruction of further theories of linguistics, it can be studied whether certain inter theoretical relations hold. It aims to be a contribution to the discussion on the foundations of linguistics.

structural linguistics - structuralist approach - lawlikeness -
theoretical terms - theory change

1 Introduction

The aim of this work is to provide a logical reconstruction of Leonard Bloomfield's linguistic theory. Only few work has been done so far in the philosophy of linguistics, concerning logical reconstructions of linguistic theories. By the application of the methodological framework of the so-called structuralist approach (see Balzer, et.al. 1987), we reconstruct Bloomfield's theory. The reconstruction will provide new insights as it shows how the notions of Bloomfield's theory are interrelated. Furthermore, the issues of lawlikeness and theoretical terms in Bloomfield's theory will be addressed. A logical reconstruction of Bloomfield's theory also opens a way for future work on intertheoretical relations between linguistic theories and, in a broader philosophical sense, can be seen as an important fundamental contribution that can be used in the discussion on theory change and scientific realism, applied to linguistics.

Leonard Bloomfield is widely recognized as one of the most important linguists in the in the first half of the twentieth century. Especially in the phase before Noam Chomsky *revolutionized* linguistics. Bloomfield's theory of *structural* linguistics provided the basic fundament for later theories. His theory was extremely influential in the community of linguists in that time. After the publication of his first book *An introduction to the study of language* in 1914, Bloomfield dedicated his work to the study of the Algonquian languages, especially to Menomini, as his influential work *Menomini Morphophonemics* shows. Bloomfield's main work is his 1933 *Language*. He presents his whole theory in this work. This work is a refined version of his 1914, though it had been changed substantially in many chapters and parts of his theory. This is especially the case for his theory of meaning, which changed from a mentalist position in 1914, to a radical behaviorist one in 1933. Due to the whole of Bloomfield's work and the great influence it had, the so-called school of *American Structuralist Linguistics* arose. Until the upcoming of Chomsky's highly influential early wok in the late fifties, structural linguistics was seen as the *standard* approach in linguistics.

Earlier and during the same time, many structuralist schools in different places were developed. All of them had in common that they related back to Ferdinand de Saussure's structuralist linguistics. The so-called Copenhagen-school, with its main representative figure Louis Hjelmslev and the Prague-school with its main figures Roman Jakobson and Nikolai Trubetzkoy are generally counted as the central figures. What all these structuralist ap-

proaches have in common is their focus on language as a structured (ordered and recurrent) phenomenon, and that the best way to study language is to understand it as consisting of certain smaller structural parts, into which it should be decomposed. The name structuralism may have little in common with other structuralisms in other fields like in philosophy, mathematics, anthropology or literary theory. The main motivation for calling these linguistic schools structuralism comes probably out of the history of phonology. There, one of the core figures was Jan Baudoin de Courtenay, who understood language as a composition of small, structured units, which actually realize sounds. It was Baudoin de Courtenay who introduced the notion of phoneme into linguistics. Later, it was the group of european structuralists like Trubetzkoy and Hjelmslev that systematized it ¹.

Besides many other works, Bloomfield's 1926 *A Set of Postulates for the Science of Language* is his own intent of axiomatizing linguistics. He outlines a list of definitions and assumptions, which aim to state clearly what linguistics is about. In this sense, this work of Bloomfield counts as a work on the foundations of his own scientific discipline and can also be seen as a contribution to the philosophy of linguistics. It is of a special importance for a logical reconstruction of Bloomfield's theory. Bloomfield states the importance of what he calls the *postulational method*:

The method of postulates (that is, assumptions or axioms) and definitions is fully adequate to mathematics; as for other sciences, the more complex their subject-matter, the less amenable are they to this method, since, under it, every descriptive or historical fact becomes the subject of a new postulate. Nevertheless, the postulational method can further the study of language, because it forces us to state explicitly whatever we assume, to define our terms, and to decide what things may exist independently and what things are interdependent (ibid: 153).

In this work, Bloomfield lists the fundamental postulates and definitions of his theory. He aims to contribute to a clarification to the object of study of the in 1926 yet *immature* science of linguistics. Bloomfield's motivation of making linguistics a more precise science can be seen as continuous with what has been called the *Wissenschaftliche Weltauffassung* or *Scientific World-View* by members of the Vienna Circle as Otto Neurath and Rudolf Carnap.

¹For a detailed study of the history of structural linguistics, see Seuren (1998).

Bloomfield shared many meta-theoretical assumptions with Neurath and, common in the years before World War II, also to Bloomfield a *scientific* world-view had become attractive. This can also be seen in the fact that Neurath invited Bloomfield to contribute in his “International Encyclopedia of Unified Science”, where Bloomfield published his *Linguistic Aspects of Science* in 1950². Already in his 1926, Bloomfield points out quite clearly what he expects of a mature science of language:

Also, the postulational method saves discussion, because it limits our statements to a defined terminology; in particular, it cuts us off from psychological dispute. Discussion of the fundamentals of our science seems to consist one half of obvious truisms, and one half of metaphysics; this is characteristic of matters which form no real part of a subject: they should properly be disposed of by merely naming certain concepts as belonging to the domain of other sciences (ibid: 153-154).

In this passages, Bloomfield’s motivation of clarifying linguistics comes out clearly. For a logical reconstruction of Bloomfield’s theory in the next chapter, beside his *Set of Postulates*, we will consider his 1933 *Language* to be of central importance.

²see Ernst, P. et.al, 2002, for more detailed information on Bloomfield’s contact to Neurath and Carnap.

2 Central notions of Bloomfield's theory

In this section, we introduce the central notions and concepts of Bloomfield's theory. We will provide a list of the most important concepts of the theory, explaining them through examples and showing textual evidence by quoting original passages of Bloomfield's works. The formal reconstruction and representation of Bloomfield's theory will be shown in the next chapter.

1. Bloomfield introduces the notion of **utterance** as one central element of his theory. Utterances are produced by acts of speech. The following quotes illustrate Bloomfield's position: *An act of speech is an utterance* (1926: 154). *A speech-utterance is what mathematicians call a continuum; it can be viewed as consisting of any desired number of successive parts* (1933: 76). Example: We imagine a speaker. By making an act of speech, she makes an utterance. So, any kind of act of speech brings out an utterance.
2. *A speech community is a group of people who interact by means of speech* (1933: 42) and *The totality of utterances that can be made in a speech community is the language of that speech-community* (1926: 155). This is necessary if we want to distinguish one language from another. As it will be shown below, this concept is of central importance for Bloomfield's theory. As simple examples, we can think of the group of speakers of english and the group of speakers of german.
3. **Bloomfield's fundamental assumption of linguistics:**

In order to make sense of Bloomfield's fundamental thesis of likeness of utterances, which he needs to distinguish groups of speakers (or speech communities), the following quote will be helpful:

To recognize the distinctive features of a language, we must leave the ground of pure phonetics and act as though science had progressed far enough to identify all the situations and responses that make up the meaning of speech-forms. In the case of our own language, we trust to

our everyday knowledge to tell us whether speech-forms are “the same” or “different”. Thus, we find that the word ‘man’ spoken on various pitch-schemes is in English still “the same” word, with one and the same meaning, but that ‘man’ and ‘men’ . . . are “different” words, with different meanings. In the case of a strange language we have to learn such things by trial and error, or to obtain the meanings from someone that knows the language . . . the study of significant speech-sounds is phonology or practical phonetics. Phonology involves the consideration of meanings. The meanings of speech-forms could be scientifically defined only if all branches of science, including, especially, psychology and physiology, were close to perfection. Until that time, phonology and, with it, all the semantic phase of language study, rests upon an assumption, **the fundamental assumption of linguistics: we must assume that in every speech-community some utterances are alike in form and meaning** (1933: 77-8).

By working with this assumption, the bloomfieldian linguist can start to distinguish one group of speaker from another one and, most importantly, to classify all so-called speech-forms. Out of these speech forms, the linguist classifies the whole grammar of a language.

4. Now we will turn to Bloomfield’s theory of semantics, which is behavioristic. The following quote illustrates Bloomfield’s **behaviorist conception of meaning**:

Psychology, in particular, gives us this series: to certain stimuli A a person reacts by speaking; his speech B in turn stimulates his hearers to certain reactions C. By a social habit which every person acquires in infancy from his elders, A-B-C are closely correlated. Within this correlation, the stimuli A which cause an act of speech and the reactions C which result from it, are very closely linked, because every person acts indifferently as speaker or as hearer. We are free, therefore, without further discussion, to speak of vocal features or sounds B of stimulus-reaction features A-C of speech (1926: 154).

Example: We imagine a situation A where a person receives a stimuli, say, she feels hungry. Then, she might utter something like: “I am hungry!”. The actual utterance is the situation B, to speak with

Bloomfield. This utterance, then, will stimulate others to certain reactions, linguistic or non-linguistic, this is Bloomfield's *C*.

5. The notion of **form** is central for Bloomfield. Linguistic forms are different kinds of units of language, like morphemes or words. *The vocal features common to same or partly same utterances are forms ... Thus a form is a recurrent vocal feature which has meaning ... Meaningful unit of linguistic signaling, smallest or complex: linguistic form; the meaning of a linguistic form is a linguistic meaning* (1933: 264).

Forms are abstract, theoretical concepts. They are non-empirical, as opposed to utterances, with which the linguist is confronted at the beginning of his work. Any word is a form. Also the components of words, in their minimal occurrence, the *morphemes*, are forms.

Definition 1:

x is a *form* $:\leftrightarrow x$ is recurrent $\wedge x$ is meaningful

6. *A minimum form is a **morpheme** ... thus a morpheme is a recurrent (meaningful) form which cannot in turn be analyzed into smaller recurrent (meaningful) forms. ... a minimum form is a morpheme. Hence any unanalyzable word or formative is a morpheme ...* (1926: 155-156). Parts of bigger linguistic constructions like words are morphemes, e.g. english morphemes as '-ness', '-hood', or '-ing'. We are now able to define 'morpheme' in Bloomfield's theory:

Definition 2:

x is a *morpheme* $:\leftrightarrow x$ is a form and $\neg\exists y (y \text{ is a form } \wedge y < x)$

7. **Free and bound forms:**

A form which may be an utterance is free. A form which is not free is bound (1926: 155). A minimum free form, for example, is any word,

like ‘house’. ‘Free’ aims to suggest that it can stand alone and does not necessarily have to occur within a bigger linguistic construction. All that can be uttered with meaning is a free form, then. As opposed to this, a bound form would be a morpheme, like ‘-ness’. This morpheme, uttered alone, is not an utterance in Bloomfield’s sense, it has no meaning. Morphemes, on the other hand, are understood as bound forms. They always occur “bound”, or *connected* with other words, like in ‘happi-ness’.

Definition 3:

x is a *free form* $:\leftrightarrow x$ is an utterance

Definition 4:

x is a *bound form* $:\leftrightarrow \neg\exists y (y \text{ is an utterance} \wedge y = x)$

8. **Word:**

Concerning the definition of a word, Bloomfield says: *A minimum free form is a word. A word is thus a form which may be uttered alone (with meaning) but cannot be analyzed into parts that may (all of them) be uttered alone (with meaning)* (1926: 156). It is important to note that the emphasis lies on what can be uttered ‘alone’ are words. We can think of any word, like ‘hello’, ‘stop’, etc.

Definition 5:

x is a *word* $:\leftrightarrow x$ is a free form and $\neg\exists y (y \text{ is a free form} \wedge y < x)$

9. **Phrase:**

Phrases are used in grammar to distinguish the substructural parts of sentences. Today, it is standard to distinguish between *noun-phrases*

like ‘the dog’ or *verbal phrases* like ‘bites’, amongst other types of phrases. As textual evidence, Bloomfield says: *A non-minimum free form is a phrase* (1926: 156). Phrases can stand alone, like words.

Definition 6:

x is a *phrase* $:\leftrightarrow x$ is a free form and $\exists y$ (y is a free form $\wedge y < x$)

10. **Syntactic constructions:**

Now we will approach to what is part of syntactic theory in Bloomfield. The notion of construction is central here. *Different non-minimum forms may be alike or partly alike as to the order of the constituent forms and as to stimulus-reaction features corresponding to this order. The order may be successive, simultaneous (stress and pitch with other phonemes), substitutive (French au for a le, and so on). Such recurrent sameness of order are constructions . . . The number of constructions in a language is a small sub-multiple of the number of forms. Each of the ordered units in a construction is a position. Each position in a construction can be filled only by certain forms (1926: 157-8). Syntactic constructions, then, are constructions in which none of the immediate constituents is a bound form* (1933: 184).

Definition 7:

x is a *syntactic construction* $:\leftrightarrow \neg \exists y$ (y is a constituent of $x \wedge y$ is a bound form)

11. **Sentence:**

The notion of sentence is explained as follows by Bloomfield: *A maximum construction in any utterance is a sentence* (1926: 158). Interestingly, he speaks of a maximum construction, letting us note that there is no construction which can be ‘bigger’ than a sentence. This

goes along with our intuitions, for in every day use of language, what we understand to be the largest linguistic constructions are usually sentences. We define a *bloomfieldian sentence* as follows:

Definition 8:

x is a *sentence* $:\leftrightarrow x$ is a construction and $\neg\exists y (y \text{ is a construction } \wedge y > x)$

12. **Phoneme:**

The notion of phoneme is also of central importance in Bloomfield's theory. The phonemes are related to the linguistic forms and to the morphemes and are necessary to constitute the field of phonology within the whole discipline of linguistics. For Bloomfield *a minimum same of vocal feature is a **phoneme** or distinctive sound. The number of different phonemes in a language is a small sub-multiple of the number of forms. Every form is made up wholly of phonemes (1926: 157) ... we can find forms which partially resemble pin, by altering any one of three parts of the word. We can alter first one and then a second of the three parts and still have a partial resemblance ... pin-tin-tan ... and if we alter all three parts, no resemblance is left, as in pin-tin-tan-tack. Further experiment fails to reveal any more replaceable parts in the word pin: we conclude that the distinctive features of this word are the three indivisible units. Each of these units occurs also in other combinations, but cannot be further analyzed by partial resemblances: each of the three is a **minimum unit of distinctive sound-feature, a phoneme** (1933: 79).*

Definition 9:

x is a *phoneme* $:\leftrightarrow x$ is a distinctive sound $\wedge \neg\exists y (y \text{ is a distinctive sound } \wedge y < x)$

3 Structuralist Reconstruction

For the logical reconstruction of Bloomfield’s theory, we apply the approach of structuralist meta-theory, where theories are understood as classes of model-theoretic structures. The logical structure of an empirical theory is outlined in terms of set-theoretic predicates, as it was introduced first by Suppes (1957).³ During the last decades, many case studies out of different branches of science have been carried out (see Balzer, et.al., 1996, also Díez, et.al., 2002). By applying the formal tools of set theory, the aim of the structuralist approach is to provide more information about the logical structure of empirical theories, as it could be provided by the application of methods of first order propositional logic. In what follows, we will characterize Bloomfield’s theory within the framework of the structuralist approach.

The framework: In structuralist meta-theory, an empirical theory consists of its models, which are sequences of the form:

$$\langle D_1, \dots, D_m, R_1, \dots, R_n \rangle$$

The D_i are so-called basic sets and the R_j are relations constructed on these sets. The D_i contain what is taken to be the ontology of the theory, i.e. they contain the *objects* assumed by the theory as *real*, the objects (or the branch of the world) the theory is about. The existence of the entities which are taken to be the elements of the basic domains of our structures is merely a posit. It is noteworthy that also in structuralist meta-theory, objects do only exist within these domains, which are itself a constitutive part of a structure and specified by the R_j , which are usually functions⁴. In empirical theories which make use of quantitative tools, they usually are functions mapping empirical objects into the real numbers, or some other mathematical entities.

To the philosophical motivation on structuralist meta-theory, Moulines (2008: 163) says “Structuralism owes his name to the fundamental thought that the most adequate way of interpreting and understanding what a scientific theory is, does not consist in conceiving it as a set of statements, but rather in conceiving it as a form or collection of different types of complex structures, which themselves are built up of simpler structures”.

³For the programmatic outline of the structuralist program, see Balzer, et.al., 1987

⁴Hence the name structuralism, or structuralist meta-theory seems reasonable.

More specifically, in structuralist meta-theory, a theory is understood to consist of the following sets of models:

1. An empirical theory T , ($T = \langle K, I \rangle$) consists of the sets of its core K and the sets of the intended applications I . K itself consists of sets of potential models M_p , partial potential models M_{pp} , actual models M , global constraints GC and the global links GL .
2. The I are the sets of the intended applications of a theory. These are not formally characterized. Their determination depends on pragmatic constraints.
3. A theory-element is then, formally, the following tuple:

$$T = \langle M_p, M_{pp}, M, GC, GL, I \rangle$$

A set of **potential models** (M_p) fixes the general framework, in which an actual model of a theory is characterized. All entities that can be subsumed under the same conceptual framework of a given theory are members of the sets of the potential models of this theory. Sets of **partial potential models** (M_{pp}) represent the framework for the corroboration or refutation of the theory in question, they represent the framework of data, which shall corroborate or refute a theory. The concepts in M_{pp} can be determined independently of T . Terms which are theoretical (and proper to T) in the potential models of the respective theory are cut out. Sets of models which do not only belong to the same conceptual framework, but also satisfy the laws of the same theory are called the sets of **actual models** (M) of a theory T . Local applications of a theory may overlap in space and time. The sets of **global constraints** (GC) are formal requirements that constrict the components of a model in dependence of other components of other models. Constraints express physical or real connections between different applications of a theory, i.e. the *inner*-theoretical relations. The sets of **global links** (GL) represent the intertheoretical connections between different theories.

3.1 Potential models of *TBL*

$M_p(TBL)$: x is a potential model of the theory of Bloomfield's linguistics ($x \in M_p(TBL)$) iff there exist: $U, \mathfrak{G}, E, A, \mathfrak{F}, M, P, T, \mathfrak{T}, s, t, \approx, form, In, Out, concat, \leq$ such that:

1. $x = \langle U, \mathfrak{G}, E, A, \mathfrak{F}, M, P, T, \mathfrak{T}, s, t, \approx, form, In, Out, concat, \leq \rangle$
2. $U, \mathfrak{G}, E, A, \mathfrak{F}, M, P$ are finite and non-empty.
3. T is a closed interval of \mathbb{R} of positive length.
4. \mathfrak{T} is a set of closed subintervals of T of positive length.
5. $s : U \rightarrow \bigcup \mathfrak{G}$
6. $t : U \rightarrow \mathfrak{T}, t(u)$ is the least temporal interval in which u was produced.
7. $\approx \subseteq U \times U$
8. $form : U \rightarrow \mathfrak{F}$
9. $In \subseteq E \times \mathfrak{F}$.
10. $Out \subseteq \mathfrak{F} \times A$.
11. $concat : \mathfrak{F}^\infty \times \mathfrak{F}^\infty \rightarrow \mathfrak{F}^\infty$.
12. $\leq \subset \mathfrak{F}^\infty \times \mathfrak{F}^\infty$.

This represents the general framework of Bloomfield's theory. All concepts of the theory are explained within the potential model of *TBL*. The basic intended interpretation is as follows:

1. The set U is a set of possible but concrete utterances (of words, phrases, sentences). So this does not include utterances of phonemes or morphemes.
2. \mathfrak{G} is a set of groups of speakers. The set of groups of speakers is important for explaining the notion of likeness of utterances.
3. In order to represent Bloomfield's semantics formally, we introduce the following notions:

E : A set of possible events (within T).

A : A set of possible actions of members of $\bigcup \mathcal{G}$.

The input-relation $In \subseteq E \times \mathfrak{F}$.

The output-relation $Out \subseteq \mathfrak{F} \times A$.

4. \mathfrak{F} is set of linguistic forms. At the same time, this is the set of meaningful forms, that is, every form is a meaningful form.
5. M is a set of morphemes.
6. P is a set of phonemes.
7. The function $s : U \rightarrow \bigcup \mathcal{G}$, from the set of utterances into the union set of the set of groups of speakers, where the value $s(u)$ of the function s at u is the speaker who produced the utterance u .
8. We introduce the function $t : U \rightarrow \mathfrak{T}$, from the set of utterances into the set of closed subintervals of T , where the value $t(u)$ of the function t at u is the least temporal interval in which the utterance u was produced (which we assume to exist).
9. We introduce the following similarity relation:
 $\approx \subseteq U \times U$: meaning that an utterance u is in the relation \approx to an utterance v iff u is at least partly like v .
10. In connection to this, the function $form : U \rightarrow \mathfrak{F}$, is introduced. Here, the value of the function $form(u)$ is the form of an utterance u , meaning that utterances can be classified into all the different forms like words, phrases, etc.
11. Several linguistic forms can be concatenated. We introduce the function $concat : \mathfrak{F}^\infty \times \mathfrak{F}^\infty \rightarrow \mathfrak{F}^\infty$. This is the concatenation function on forms, where
 $(\mathfrak{F}^\infty = \{\langle f_1, \dots, f_n \rangle | f_i \in \mathfrak{F}, n \geq 1\})$.

12. Finally, we want to express that two or more linguistic forms can be combined in order to build bigger linguistic forms. Morphemes, for instance, are connected and construct bigger forms like words. These then can be connected to build up bigger forms, like phrases. Hence, we introduce an ordering relation on the set of linguistic forms. We call this the *parthood* relation for forms: $\leq \subset \mathfrak{F}^\infty \times \mathfrak{F}^\infty$.

3.2 Actual models of *TBL*

TBL is an empirical theory of natural language. Being an empirical theory requires that it contains some laws, or at least lawlike statements. The issue of lawlikeness in the philosophy of science is varied and controversial. It might be intuitively clear that in physics, laws are easily identifiable and their range of applicability is almost always empirically testable. But not so in linguistics. If we want to contribute to the discussion of lawlikeness in linguistics, the correct way to go, we argue, will be to proceed from a concrete empirical theory of language, as it is our example of *TBL*. If laws or lawlike statements can be identified in *TBL*, it might help to establish more general conclusions on the issue of lawlikeness in linguistic theory. For the determination of the laws, or lawlike statements of *TBL*, we define an actual model of *TBL*. The fundamental principles of the theory, which are also required for the determination of the theoretical terms of *TBL*, are given:

$M(TBL) : x$ is an actual model of the theory of Bloomfield's linguistics ($x \in M(TBL)$) iff there exist $U, \mathfrak{G}, E, A, \mathfrak{F}, M, P, T, \mathfrak{T}, s, t, \approx, form, In, Out, concat, \leq$, such that:

1. $x = \langle U, \mathfrak{G}, E, A, \mathfrak{F}, M, P, T, \mathfrak{T}, s, t, \approx, form, In, Out, concat, \leq \rangle \in M_p(TBL)$
2. Within any $\mathfrak{G} \in \bigcup \mathfrak{G}$, \approx contains many edges, but between two distinct $\mathfrak{G}_1, \mathfrak{G}_2 \in \bigcup \mathfrak{G}$, \approx contains few edges.
3. \approx is reflexive and symmetric.
4. $A \subseteq E$.
5. $M \subseteq \mathfrak{F}$.
6. \leq is reflexive, antisymmetrical and transitive.

Basic intended interpretation: Condition 1 states that the actual model is also element of the potential model. But further conditions are necessary if we want it to become an actual model of *TBL*. Condition 2 expresses the fundamental principle of *TBL*. Namely, that utterances of speakers within the same group of speakers are more alike than utterances of speakers from different groups. In this way, it is always possible to distinguish one language from another. Condition 3 expresses the character of this similarity relation, its being reflexive and symmetric. Condition 4 tells us that there are more events than actions, that the set of actions is a subset of the set of events.

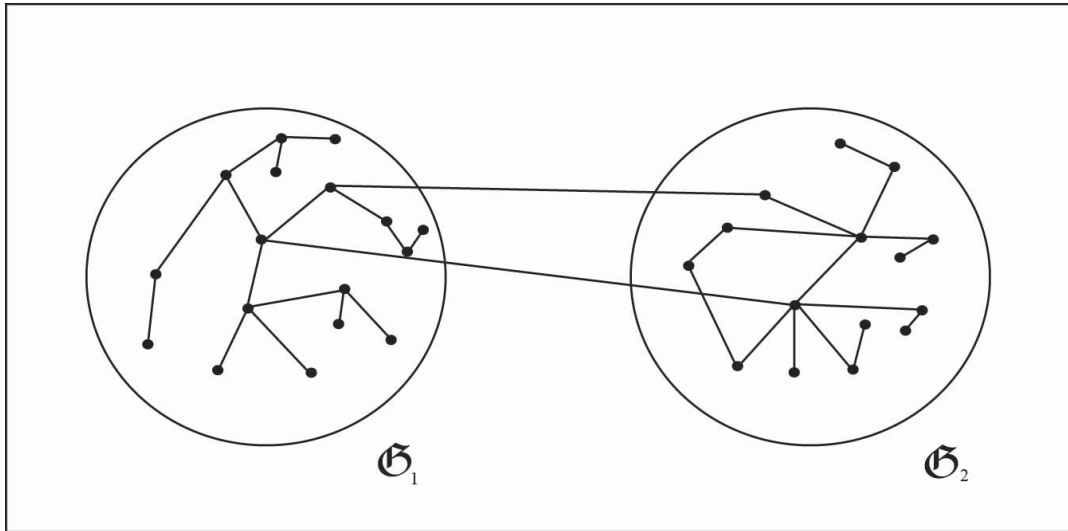


Image 1. The graphical representation of condition 2: Within any $\mathcal{G} \in \bigcup \mathcal{G}$, \approx contains many edges, but between two distinct $\mathcal{G}_1, \mathcal{G}_2 \in \bigcup \mathcal{G}$, \approx contains few edges.

3.3 Theoretical terms in *TBL*

In order to address the question of theoretical terms in *TBL*, we adopt the structuralist criterion for theoreticity, which states the following:

Term t is T-theoretical if every t -determining model is a model of T. Or, in other words, if the set of all t -determining models is included in $M(T)$, or if any method of determination for t is contained in $M(T)$... Term t being T-theoretical means that t can be determined only if T's fundamental laws are presupposed. In other words: The determination of t only works in situations in which T's fundamental laws are satisfied (Balzer, et.al., 1987: 65).

Terms can be theoretical for one theory, but appear to be non-theoretical in other theories. This criterion relativizes the notion of theoreticity and makes the status of theoreticity of a term always dependent on a concrete empirical theory, in which it occurs. In *TBL*, we say that \mathcal{G} is a t -theoretical term. In order to determinate a group of speakers, condition 2 of the actual

model of *TBL* has to be presupposed. A group of speakers is identified and determined by this condition.

Another t-theoretical term in *TBL* is \mathfrak{F} . Only if the conditions of the actual model are already presupposed, we can determine \mathfrak{F} . The notion of form is central to *TBL*. Also Bloomfield's notion of morpheme is t-theoretical. Hence the set M of morphemes is a t-theoretical term, given that morphemes are always forms and that forms are t-theoretical. In order to determine a morpheme, first it has to be clear what a form is. The functions and relations $s, form, In, Out, concat$ and \leq are further t-theoretical notions in of *TBL*. For them to be applicable, the postulation of $\mathfrak{G}, \mathfrak{F}$ or M is required.

3.4 The Partial Potential Models of *TBL*

After having clarified and determined which terms are t-theoretical in Bloomfield's theory, we are able to define the Partial Potential Models of *TBL*, where the t-theoretical terms are cut out. The Partial Potential Models are the *data-models* of a theory.

$M_{pp}(TBL) : x$ is a partial potential model of the theory of Bloomfield's linguistics ($x \in M_p(TBL)$) iff there exist: $U, E, A, P, T, \mathfrak{T}, t, \approx$ such that:

1. $x = \langle U, E, A, P, T, \mathfrak{T}, t, \approx \rangle$
2. U, E, A, P are finite and non-empty.
3. T is a closed interval of \mathbb{R} of positive length.
4. \mathfrak{T} is a set of closed subintervals of T of positive length.
5. $t : U \rightarrow \mathfrak{T}, t(u)$ is the least temporal interval in which u was produced.
6. $\approx \subseteq U \times U$

3.5 Specializations

We want to show and discuss a specialization of the laws of Bloomfield's theory. The structuralist approach proposes the following criterion for the specialization of laws.

When considering our reconstruction of Classical Particle Mechanics, the reader might already have asked himself where we have left such important laws of classical particle mechanics as Newton's third law (the actio-reactio principle), the law of gravitation, or Hooke's law. Our answer is: They all constitute different but interrelated theory-elements of classical particle mechanics. The whole array, in turn, constitutes what we might call "the theory-net of classical particle mechanics". The same holds for other advanced theories of empirical science. In the case of simple equilibrium thermodynamics, besides the fundamental equation and the constraints and links (which, admittedly, provide much of the content of this theory), one would like to see Nernst's "Third Principle of Thermodynamics", Gay-Lussac's law, and other more special laws. Many of these more special laws of the theory are, moreover, associated with particular constraints and, possibly, particular links, besides those already explicated when dealing with the "basic" theory-elements. In other words, the consideration of all these further requirements will end up in the reconstruction of a whole series of different theory-elements, which, however, have the same basic structure. Because of this similarity of structure, we can speak of a theory-net and not just an amorphous set of single, isolated theory-elements (Balzer, et.al., 1987:168).

We can think of Bloomfield's theory as the so-called *theory-element TBL*, its basic law being condition 2 of its actual model. For a specialization to obtain, it is required that the basic structure of the theory remains. This means, in structuralist terms, that its potential models are leaved unchanged, but that further requirements on the laws are added to its actual models. For *TBL*, we propose the following. Condition two of the actual model of *TBL* is required if we want to determine similarities of utterances within speaker groups and between speaker groups. If we only want to talk about one single language, the relation of similarity between utterances still holds, but will not hold between groups of speakers, but between speakers within one single group.

We say, TBL_1 is a specialization of TBL , if: Within any \mathfrak{G}, \approx contains many edges.

We obtain a specialization relation $TBL_1 \sigma TBL$, between the two theory-elements. Both theory-elements have the same basic ontology and structure (i.e. the same potential models), but they differ in their actual models.

4 Conclusion

As results of the logical reconstruction of Bloomfield's theory, we obtained information about the relations between the central terms of the theory. We determined the theoretical terms of *TBL*, by relying on the notion of theoreticity given by the structuralist approach. About the notion of lawlikeness, we saw that the fundamental principle, the lawlike statement of Bloomfield's theory, concerns the individuation of groups of speakers by a *similarity relation*, which Bloomfield needs first in order to establish his whole theory. We also obtained information about a specialization of Bloomfield's law about the individuation of speaker groups.

The reconstruction of Bloomfield's theory can be taken as a starting point for the study of intertheoretical relations between structural linguistics (being Bloomfield's theory the main representative) and other theories of language, as it might be transformational grammar, construction grammar or cognitive linguistics. In this sense, it should be seen as a first step towards a reconstruction of intertheoretical relations between linguistics theories. Understanding this work as one first contribution, we expect also future insights related to the debate on scientific realism.

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5 Appendix

More textual passages of Bloomfield's theory will be shown here. Further notions which are also part of his theory are mentioned.

All forms having the same functions constitute a form-class. Examples of English form-classes are: noun-stems, number-affixes, object expressions, finite verb expressions (1926: 159) .

A form which may be an utterance is free. A form which is not free is bound (ibid. 155)

Formative: A bound form which is part of a word is a formative. A formative may be complex, as, Latin verb endings -abat, -abant, -abit, -abunt, etc., or minimum (and hence a morpheme), as Latin -t of third person (1926: 156).

Substitution: 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 (1933: 247).

Every utterance is made up wholly of forms (1926: 155).