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IS LINGUISTIC SEMANTICS AXIOMATICALLY TANGIBLE?
(A TENTATIVE APPROACH)

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Everything is different than it appears at first sight, including language. How many times is it necessary to look at it in order to see it for the very first time?

1. INTRODUCTION

The title of this brief inquiry into theoretical semantics is formulated as a question to which any conceivable answer seems to be equally probable. This question could be reformulated, somewhat freely but nevertheless with a similar degree of uncertainty, as: Can one attempt to axiomatize linguistic semantics without being perceived as inadvertently humorous? Searching for an answer to this question is also disheartning. But it may happen that in a certain moment, captivated by a sudden surge of courage, one puts a stop to one's idle ruminations and simply starts writing. However, as one progresses towards the completion of his article doubts increase in almost geometric progression. Regretfully, it is felt that it is already too late to retreat, so the only commendable thing left to do in this situation is to apologize in advance to readers for possibly wasting their time and to prevent the article from assuming alarming proportions.

Thus, let us continue by saying that our inquiry is intended as very preliminary indeed. The aim is, in fact, to propose for consideration a fragment of a semantic theory formulated axiomatically. A relatively complete theory treating the whole of semantics is for the time being hardly imaginable, and its construction would be an overwhelming task, since, metaphorically speaking, all language is semantically based. Each lingual subdomain serves semantics, that is, has a semantic aspect. Consequently, it is fully justified to speak of phonological, morphological, lexical, or syntactic semantics.

Language allows humans to communicate about the world outside the realm of language. The relationships between these two realities, language reality and extralingual reality, are at the foundation of semantics. Language signs are used not only to identify various entities within the extralingual world and to impose a certain structure upon it but also, to a certain extent, to create it. Needless to say, the correct use of language signs presupposes an appropriate semantic knowledge on the part of the linguators involved. This knowledge is but a single component of their entire language knowledge as described by linguistic theories. Consequently, semantic theories describe linguators' semantic knowledge. How this knowledge can be conceived of will be briefly touched upon in the next section.

The theory to be subsequently outlined not only continues and further develops some of the ideas already proposed elsewhere by the present author (cf. Bańczerowski 1980, 1997, 1999), but also contains new suggestions. Its structure is relatively simple, since as currently formulated, it consists only of two main components which, respectively, present:

(i) the primitive terms, and
(ii) the system of axioms.

As can be rightly supposed, the axiomatic method applied to formulate our theory will necessarily presuppose making use of a logico-mathematical apparatus, which in spite of its rudimentary nature will be briefly explained in Notes.

2. SEMANTICS AND SEMASY

Semantics, if conceived of as a discipline dealing with lingual signs, forms a component of semiotics (semiology), which investigates signs of all kinds. More precisely, semantics could be viewed as a subclass of linguistic theories, the subject matter of which are certain fragments of all ethnic languages, that is, semantic knowledge of the linguators of those languages. The image of this subject matter projected by semantics assumes the form of what could be called ***semasy***, to be treated as the domain of semantics. This latter could be imagined as a system consisting of all signs and, at least, of two kinds of relations:

(i) the relations between signs and extralingual entities, and
(ii) the relations between signs, with respect to their relations to extralingual entities.

Of course, the domain of semantics, that is, semasy, should mirror the semantic knowledge of linguators. Or, more exactly, semasy should be an adequate image of this knowledge.

Semantics as a class of linguistic theories which form a science of lingual signs, while inquiring into semantic knowledge of ethnic linguators, can be divided into two subdisciplines: general and particular. The former constructs theories which apply to all languages. It would be thus a discipline analogous to general phonetics, general morphology, or general syntax. The range of application of particular semantic theories would be limited to an individual language or group of languages. Thus, by applying the conceptual apparatus and propositional content of general semantics to a particular language *L*, a grammar or a theory of this language is constructed. And, this theory could be called a semantic grammar of or for *L*. The theory presented subsequently can be termed a general descriptive semantic theory.

Reflections upon the relationship between lingual signs and extralingual reality have a relatively long tradition and they date back to antiquity. However, this early semantic thought appeared primarily in conjunction with the exegesis of sacred texts. Thus, religiously inspired and especially written language provided a stimulus for the development of semantics (cf. Bekkum van, et al. 1997).

3. PRIMITIVE AND SOME AUXILIARY DEFINED TERMS

The conceptual apparatus utilized in our theory will be mirrored in its primitive and defined terms. At first, the list of primitive terms and subsequently their explanation will be given. As concerns the defined terms, only some of them will be introduced to the extent as the fragmentary nature of this theory requires it.

Before we further proceed, let us still notice that the choice of primitive terms seems to justify the conjecture that semantics is epistemologically relatively independent from other linguistic subdisciplines.

3.1 List of primitive terms

(i)	***Utr***	–	the set of all utterances,
(ii)	***Sgn***	–	the set of all signs,
(iii)	***Seg***	–	the set of all linguistically relevant segments,
(iv)	***sg***	–	the relation of signation,
(v)	$\mathfrak{Sgt}$	–	the set of all signata,
(vi)	***hfn***	–	the relation of homophony,
(vii)	***DSE***	–	the set of all semantic dimensions,
(viii)	***dsg***	–	the relation of designation,
(ix)	***sgf***	–	the relation of signification,
(x)	***dsb***	–	the relation of designatability,
(xi)	***sfb***	–	the relation of signifiability,
(xii)	***sgtz***	–	the relation of significatization,
(xiii)	***dsr***	–	the relation of designative radius (range),
(xiv)	***lkf***	–	the relation of lexification,
(xv)	***smf***	–	the relation of semification,
(xvi)	***qf***	–	the relation of qualification,
(xvii)	***qfb***	–	the relation of of qualifiability.

3.2 Signs, signation, and signata

It is our usual practice to start the list of primitive terms with the set of utterances, which, however, are not conceived of completely in line with the usual linguistic practice. An utterance is treated by us as a minimal communicative unit, which, in a certain sense, is complete and indivisible. Some utterances may assume the form of sentences, whereas others do not. Each utterance will be viewed as an individual, concrete, spatio-temporal entity, produced *hic et nunc*, by a definite speaker, in a definite time and space, and by virtue of which it exhibits the property of actuality. Consequently, it cannot be used repeatedly but only once. The set of all utterances is denoted by ***Utr***. The formula $x \in$ ***Utr*** reads: x is an utterance.

Utterances are produced with the purpose of representing, or referring to, certain entities of extralingual reality. The property of referring to extralingual entities is also displayed by certain segments, which can be distinguished within utterances. Generally speaking, language objects which in the acts of interhuman communication stand for, or represent, or are applicable to, the entities of extralingual reality, are usually called ***signs***. The set of all signs will be denoted here as ***Sgn***. The formula $x \in$ ***Sgn*** will be read: x is a sign.

In order to avoid any misunderstanding, let us state that signs, similarly to utterances, of which they are parts (segments), will be treated as being spatio-temporal objects existing at one time, that is, objects stamped by the property of actuality. It will also be tacitly assumed that each lingual sign is a sign of an ethnic language, and that there are linguators capable of using signs competently in order to obtain certain goals in the appropriate situations.

Signs are thus not only utterances themselves, but also segments of a certain kind occurring within utterances. However, within signs, segments can also be distinguished which are not signs themselves, but turn out to be indispensible for linguistic analysis. The set of all linguistically relevant segments thus comprises both signs and non-signs, and will be denoted by ***Seg***. The formula $x \in$ ***Seg*** reads simply as: x is a segment.

The property of lingual signs to stand for the corresponding entities of extralingual reality will find a formal counterpart in the ***relation of signation*** to be denoted by ***sg***. The formula x ***sg*** σ will be read: sign x signates an entity σ. Needless to say, the relation ***sg*** could also be viewed as a formal reflection, in a certain sense, of the signative acts performed by linguators.

The predecessor of the relation ***sg*** is thus always a sign, and its successor – an extralingual entity, which could be called ***signatum***. The set of all signata is denoted by the symbol $\mathfrak{Sgt}$. The formula $\sigma \in \mathfrak{Sgt}$ reads: σ is a signatum. Consequently, at the outset of our semantic considerations the following important triad emerges:

Signum – signātio – signātum.

Signs may enter various relations with respect to various of their properties. Semantically based relations will be dealt with later on. Here, we would like to briefly mention the ***relation of homophony*** (***hfn***), distinguished to account formally for the auditory indistinguishability of segments. The formula x ***hfn*** y reads: segment x is homophonous with segment y.

3.3 Signative space and semantic dimensions

The inquiry into semantics necessarily thus presupposes taking into consideration the universe of signata, which form extralingual reality. For semantics, it is not irrelevant how this universe is conceived of. The task of constructing a semantic theory is hardly feasible without making some epistemic and ontic commitments concerning extralingual reality, which, containing various kinds of entities – empirical and extraempirical, real and virtual, exhibits its multi-aspectuality and multi-sortality. Divergent options are possible in approaching it. In other words, extralingual entities may be viewed from various angles.

Looked at from the set-theoretic perspective, these entities are fairly diversified and they form a hierarchy *sui generis*. The totality of objects, which set-theory deals with, is subdivided into an infinite number of kinds, called types. The simplest type is represented by individuals, usually conceived of as spatio-temporal entities (wholes), which are not sets. The next type is represented by sets of individuals, and it is, in turn, followed by sets of sets of individuals (i.e. families of sets of individuals), etc.

Contrary to set-theory, mereology unveils a different perspective, while treating the objects, which it deals with, as wholes *sui generis*, which have their definite and unique time of duration. Within the wholes, parts, which also are characterized by unique time of duration, can be distinguished.

Although set-theoretic as well as mereological perspectives are important for semantics, it seems nevertheless convenient to begin considerations of the structure of extralingual reality by distinguishing between two fundamental kinds of entities that belong to it, that is,

(i) quiddities, and
(ii) qualities.

This primordial distinction finds also a reflection in the concepts of argument and predicate. Qualities, in turn, could be viewed either as:

(i) properties, peculiar to the corresponding classes of quiddities, or as
(ii) waves, that is, quality waves.

Homogenous qualities form the corresponding dimensions, referred to here as semantic dimensions. More precisely, a ***semantic dimension*** could be conceived of as the set of all homogenous qualities, that is, qualities in the same respect. ***The family of all semantic dimensions*** is symbolized as ***DSE***. The formula $\delta \in$ ***DSE*** reads: δ is a semantic dimension.

The semantic dimensions specify what could be called a ***signative space***. This latter could be imagined as being permeated by quality waves. The intersection or combination of these waves brings about quiddities as wholes which are simultaneously parts of a certain number of qualities. Hence, the relation between a quiddity and each of its qualities would be the mereological relation obtaining between a part and the corresponding whole.

Semantic dimensions are thus magnitudes serving to determine the properties of quiddities appearing in signative space. Quiddities do not exist independently of this space.

The so-called 'semantic primitives' distinguished by various authors (cf. Wierzbicka 1972; Goddard and Wierzbicka 1994) are simply those qualities or dimensions, which have a universal nature.

Signative space is dynamic. It is not fixed once and for all in all its dimensions but its dimensionality is to a certain extent constantly being changed. Some dimensions may vanish or be created anew. By means of signation quiddities and qualities are identified as well as called into existence, whereby a dynamic organization is imposed upon extralingual reality, which is constantly structured and restructured. What is more, one and the same extralingual entity may be either:

(i) quidditatified, or
(ii) qualitatified.

These two operations depend thus on how the entity in question is being signated.

There is a close interdependency between the family ***DSE*** and the ***relation of significative homogeneity Sfhg***, since each semantic dimension is here conceived of as a set of homogeneous qualities. Consequently, the assumption of one of these terms as primitive presupposes the definability of the other. Thus, the definition of the relation ***Sfhg*** could be formulated as follows:

Df 3.0 $$\boldsymbol{Sfhg} = \{(\sigma_i, \sigma_j): \bigvee_{\delta} (\delta \in \boldsymbol{DSE} \wedge \sigma_i, \sigma_i \in \delta)\}$$

However, we are not certain whether it would not be more intuitive to treat this relation as primitive instead of the family ***DSE***.

3.4 The mode of signation

Signs not only signate extralingual entities but they do so in a certain mode, that is, they either designate or signify. Consequently, two aspects of signation will be formally captured in terms of the following relations:

(i) the ***relation of designation*** (***dsg***), and
(ii) the ***relation of signification*** (***sgf***).

The formula x ***dsg*** σ_i reads: sign x designates entity σ_i, and the formula y ***sgf*** σ_j reads: sign y signifies entity σ_j. The predecessor of the relation ***dsg*** will be called ***designator***, and its successor ***designatum***. The predecessor of the relation ***sgf*** will be called ***significator***, and its successor – ***significatum*** or, simply, a ***meaning***. Thus, if x is a sign, its designatum will be denoted by the symbol ***dsg***‘x, and its total meaning by the symbol ***sgf***$^{>}x$.

However, it is still extremely important to observe, that the relation ***dsg*** expresses a certain actuality or, more exactly, the actuality of particular designative acts, that is, acts

which were, are, or will be actually performed, and hence this relation could be called the ***relation of actual designation***.

The following definitions introduce in due order:

(i) the ***set of all designators*** (***Dsgr***),
(ii) the ***set of all significators*** (***Sgfr***),
(iii) the ***set of all designata*** (***Dsgt***), and
(iv) the ***set of all significata*** (***Sgft***).

Df 3.1 $$\boldsymbol{Dsgr} = \{x: x \in \boldsymbol{Sgn} \wedge \bigvee_{\sigma} (\sigma \in \mathfrak{Sgt} \wedge x\, \boldsymbol{dsg}\, \sigma)\}$$

Df 3.2 $$\boldsymbol{Sgfr} = \{x: x \in \boldsymbol{Sgn} \wedge \bigvee_{\sigma} (\sigma \in \mathfrak{Sgt} \wedge x\, \boldsymbol{sgf}\, \sigma)\}$$

Df 3.3 $$\boldsymbol{Dsgt} = \boldsymbol{dsg} \rangle \boldsymbol{Dsgr}$$

Df 3.4 $$\boldsymbol{Sgft} = \boldsymbol{sgf} \rangle \boldsymbol{Sgfr}$$

The distinction between designation and signification, as two aspects of signation, will turn out to be fundamental for the present inquiry into semantics. It is by virtue of designation that a signatum is apprehended as a quiddity (whatness), and by virtue of signification – as quality (howness, whichness). We could also say that designation is simply ***quidditatification***, and signification – ***qualitatification***. What is more, one and the same signatum may be signated as either quiddity or quality.

Let us now try to elucidate the nature of designation and signification by means of exemplification, whereby the distinction between them should become more conspicuous. Thus, for example, the sign *a tree* designates a certain object called 'a tree' out of the class of all such objects. Thus, 'a tree' is the designatum of *a tree*. In addition to its designation this sign also signifies the properties (significata) of its designatum, to which among others the following belong:

(i) perennial plant,
(ii) woody self-supporting stem,
(iii) considerable height,
(iv) developing branches at some distance from the ground.

The sign *is writing* designates a certain property attributed to an object, and it signifies, among other properties of its designatum, the following:

(i) intentional action,
(ii) formation of visible characters, letters or words on the surface of some material,
(iii) use of some instrument such as pen, pencil, typewriter, computer, or some other means (for the purpose of formation of characters, letters, etc.),
(iv) performed by humans or automata,
(v) 3rd person,
(vi) non-past,

(vii) incompletion,
(viii) single action.

Thus, the designata of *is writing*, *is reading*, *is cooking* display different properties, which constitute, respectively, the meanings (significata) of these signs.

The sign (sentence) *The wind broke the window* designates a certain event, and it signifies among other meanings the following:

(i) transitivity,
(ii) activity,
(iii) preterity,
(iv) completion.

However, there are signs which are uncapable of designating, and consequently, they accomplish the function of pure significators. More information on such signs will be contained in the respective axioms. The idea of whether designation and signification are not of a gradable nature, and thus but two poles of signation also seems worthy of consideration. A particular sign could be a designator of a certain signatum to a greater degree than it could be a significator of this same signatum, or conversely.

3.5 Designatability and signifiability

In addition to the relations ***dsg*** and ***sgf***, mirror two different modes of signation, we shall distinguish:

(i) the ***relation of designatability*** (***dsb***), and
(ii) the ***relation of signifiability*** (***sfb***),

in order to account for a certain potentiality of the these modes. Thus, for example, sign x which actually designates an entity σ_1, could be used in other signative acts to designate entity σ_2 or σ_3, etc. However, this is only potential, because it is not actually feasible. Sign x, after being pronounced, immediately disappears and cannot be retrieved from the past for repeated designative use. Therefore, we shall speak here of potential designation.

The formula x ***dsb*** σ will be read: sign x could designate entity σ or, alternatively, σ could be designated by x. The set of all entities, which could be designated by x will be denoted by the symbol $\boldsymbol{dsb}^{>}x$, and called the ***designative extension*** of x. Thus, for example, the designative extension of the word-phrase *a horse* is the class of all horses. Generally speaking, the designative extension of a sign is the set of all entities, which could be the designata of that sign. Each sign as designator not only designates but also specifies its designative extension. The set of all designators, which could designate entity σ, will be denoted by the symbol $\boldsymbol{dsb}^{<}\sigma$ and called the ***designatorial extension*** of σ.

The relation ***dsb*** belongs thus to the primitive terms in our theoretical system. However, the question of whether it could be defined remains open. A tentative definition capturing some potentialty of designation could be formulated as follows:

Df(*) $$\boldsymbol{dsb} = \{(x, \sigma):\ x \in \boldsymbol{Sgn}\ \wedge\ \sigma \in \boldsymbol{Dsgt}\ \wedge \bigvee_{y} (y\ \boldsymbol{hfn} \cap \boldsymbol{hsgf}\ x\ \wedge\ y\ \boldsymbol{dsg}\ \sigma)\}$$

The relation ***sfb*** can be conceived of in a similar manner. The formula x ***sfb*** σ will be read: sign x could signify entity σ or, alternatively, σ could be signified by x. The symbol $\boldsymbol{sfb}^{>}x$ could be called the ***significative extension*** of sign x.

3.6 The radius of designation

The designative extension of a sign reflects its designative potential in a given language. However, in a concrete signative act the actual designative extension of a designator is also being specified. This kind of extension will be called the ***radius*** (***range***) ***of designation***, and the corresponding relation will be denoted by the symbol ***dsr***. The formula x ***dsr*** Σ will be read: Σ is the designative radius or range of sign x.

The radius of designation of a sign should not be confused with its designative extension. Thus, for example, the designative extension of the word-phrase *the book* is the class of all books. Also the class of all books is the designative extension of the word-phrase *a book*. However, the radius of designation of *the book* is one elemental set of designata, while in the case of *a book* it is identical with the designative extension.

Each act of designation thus presupposes the establishment of the designative ranges of the designators being used. An entity is always designated within the corresponding designative range.

3.7 Significative categorization

The significata (meanings), conceived of as properties, which are characteristic of designata, and which are signified by lingual signs, specify the corresponding categories of at least two kinds:

(i) certain categories of designata, and
(ii) certain categories of signs.

The former categorization will be formally captured in terms of the ***relation of significatization*** (***sgtz***), binding a given significatum with a designatum, which it is peculiar to. Accordingly, the formula σ_i ***sgtz*** σ_j reads: significatum σ_i is peculiar to designatum σ_j.

Thus each significatum σ specifies the corresponding designative category, that is, the class of all those designata, which possess σ. And, this category will be denoted by the symbol $\boldsymbol{sgtz}^{>}\sigma$.

Each significatum σ as well as each semantic dimension δ also specifies the respective category of signs, that is, the class of all those signs which signify σ, and the class of all those signs which signify any meaning from δ. Among these latter, categories such as Person, Number, Time, Modality, etc. can be mentioned.

3.8 Significative equality and distinction

Signs may be compared with respect to the meanings they signify. Such a comparison may reveal their respective equality or distinction. Both significative equality as well as significative distinction have a gradable nature and, consequently, may be total or partial.

Total significative equality will be formally captured in terms of ***the relation of homosignification*** (***hsgf***), to be introduced by means of the following definition:

Df 3.5 $\quad \boldsymbol{hsgf} = \{(x,y):\ x,\ y \in \boldsymbol{Sgn}\ \wedge\ \boldsymbol{sgf}^{>}x = \boldsymbol{sgf}^{>}y\}$

According to this definition, two signs (significators) x and y are homosignificative, in symbols: x ***hsgf*** y, iff they have identical significata or, equivalently, iff they signify identical meanings.

Partial significative equality, in turn, can be formally captured in terms of various relations of isosignification. We shall introduce below only one such relation, which results from the relativization of significative equality to exactly one semantic dimension. It will be called **the *relation of dimensional isosignifcation*** (***isgfd***), and its definition will assume the following form:

Df 3.6 $\quad \boldsymbol{isgfd} = \{[(x,\ y),\ \delta]:\ x,\ y \in \boldsymbol{Sgn}\ \wedge\ \delta \in \boldsymbol{DSE}\ \wedge\ \boldsymbol{sgf}^{>}x \cap \delta\ =\ \boldsymbol{sgf}^{>}y \cap \delta\ \}$

In light of this definition, two signs x and y are isosignificative with respect to semantic dimension δ, in symbols: $(x,\ y)$ ***isgfd*** δ, iff they signify an identical meaning from δ.

The absence of total significative equality will be formally captured in terms of the ***relation of significative opposition*** (***osgf***), defined as follows:

Df 3.7 $\quad \boldsymbol{osgf} = \{(x,\ y\ ):\ x,\ y \in \boldsymbol{Sgn}\ \wedge\ \neg\, x\ \boldsymbol{hsgf}\ y\}$

In agreement with this definition, two signs x and y are in significative opposition, in symbols: x ***osgf*** y, iff they are not homosignificative.

Partial significative distinction can be formally rendered in terms of various relations of dissignification which, in turn, can be relativized to one or more semantic dimensions. The ***relation of dimensional dissignification*** (***dsgfd***) will be introduced as follows:

Df 3.8 $\quad \boldsymbol{dsgfd} = \{[(x,\ y),\ \delta]:\ x,\ y \in \boldsymbol{Sgn}\ \wedge\ \delta \in \boldsymbol{DSE}\ \wedge\ \boldsymbol{sgf}^{>}x \cap \delta \neq \boldsymbol{sgf}^{>}y \cap \delta\}$

In light of this definition, two signs x and y are dissignificative with respect to dimension δ, in symbols: $(x,\ y)$ ***dsgfd*** δ, iff they signify different meanings from δ.

3.9 The mode of signification

Meanings are not only signified, but they are always signified in a certain mode. The signification mode depends upon the degree of semantic and syntactic autonomy of the significators. Two such modes will be distinguished:

(i) lexificative, and
(ii) semificative (grammatical).

Thus, having been signified, meanings are either lexified or semified by their significators or, equivalently, one could also say that significators either lexify or semify meanings. What is more, one and the same meaning can be signified in both of these modes. The lexificative/semificative duality of signification will find formal reflection in:

(i) the ***relation of lexification*** (***lkf***), and
(ii) the ***relation of semification*** (***smf***).

Both these relations belong to our primitive terms. The formula x ***lkf*** σ reads: sign x lexifies meaning σ or, alternatively, x is a lexificator of σ. And analogously, the formula x ***smf*** σ reads: sign x semifies meaning σ or, alternatively, x is semificator of σ.

The definitions which follow introduce in due order:

(i) the ***set of all lexificators*** (***Lkfr***),
(iii) the ***set of all semificators*** (***Smfr***),
(iv) the ***set of all lexificata*** (***Lkft***), and
(v) the ***set of all semificata*** (***Smft***).

Df 3.9 $\quad \boldsymbol{Lkfr} = \{x:\ x \in \boldsymbol{Sgfr}\ \wedge\ \bigvee_{\sigma}\ (\ \sigma \in \boldsymbol{Sgft}\ \wedge\ x\,\boldsymbol{lkf}\ \sigma\ )\}$

Df 3.10 $\quad \boldsymbol{Smfr} = \{x:\ x \in \boldsymbol{Sgfr}\ \wedge\ \bigvee_{\sigma}\ (\ \sigma \in \boldsymbol{Sgft}\ \wedge\ x\,\boldsymbol{smf}\ \sigma\ )\}$

Df 3.11 $\quad \boldsymbol{Lkft} = \boldsymbol{lkf} \rangle \boldsymbol{Lkfr}$

Df 3.12 $\quad \boldsymbol{Smft} = \boldsymbol{smf} \rangle \boldsymbol{Smfr}$

Analogously to signification and signifiability

(i) the ***relation of lexifiability*** (***lkfb***) and
(ii) the ***relation of semifiability*** (***smfb***)

can be distinguished in addition to the relations ***lkf*** and ***smf***. The formula x ***lkfb*** σ reads: x could lexify σ or, alternatively, σ is lexifiable by x. The formula x ***smfb*** σ will be read mutatis mutandis analogously.

Lexification and semification thus emerge as two particular kinds of signification. Signs may also be compared with regard to the meanings they lexify or semify, and such a comparison may exhibit the respective equality or distinction of the signs in question. Lexical equality and distinction as well as semical equality and distinction may be total or partial, and they may be formally rendered by means of the corresponding ***relations of homolexy***, ***lexical opposition***, ***iso-*** and ***dislexicality***, etc. Let us now introduce the first of these relations, since further use of it will be made.

Df 3.13 $\quad \boldsymbol{hlk} = \{(x, y)\colon\ x, y \in \boldsymbol{Sgn} \ \wedge\ \boldsymbol{lkf}^{>}x = \boldsymbol{lkf}^{>}y\}$

In light of this definition, two signs x and y are homolexical, in symbols: $x\ \boldsymbol{hlk}\ y$, iff they lexify identical meanings.

3.10 Qualification and qualifiability

Signs are not only bound with extralingual entities by the relation of signification but they also may enter into various relationships with each other. Some of these relationships underlie the construction of more composite signs out of less composite ones, by virtue of exerting semantic influence upon those signs, that is, by affecting their designation and signification. The ***relation of qualification*** (***qf***) certainly belongs to the above mentioned relations. It may not only bind morphs but also words and syntagmas, whereby it forms the foundation for hypotactic structures of various kinds. Of course, besides hypotactification there are also other methods of constructing composite signs, such as paratactification or apposition, but they will not be the subject of our concern here.

The formula $x\ \boldsymbol{qf}\ y$ will be read: sign x is qualified by sign y or, equivalently, y qualifies x. Thus, for example, in the word *dogs* the morph *dog-* is qualified by morph *-s*; and in the syntagma *a black dog* the word-phrase *a-dog* is qualified by the word *black*. The relation ***qf*** is fairly general and various subrelations can be distinguished within it, such as ***morphological qualification*** (***mfq***), or ***phrasal qualification*** (***fq***).

However, the relation ***qf*** is stigmatized with actuality, since it is established based upon the signs occurring within utterances which, as should be recalled, are concrete, actual objects. Therefore, it would be more appropriate to call it the ***relation of actual qualification***. In order to account for a cerain potentiality of qualification, we shall distinguish the ***relation of qualifiability*** (***qfb***). Accordingly, the formula $x\ \boldsymbol{qfb}\ y$ will be read: sign x could be qualified by sign y.

Thus, for the time being we treat the relation ***qfb*** as a primitive term. However, it is worth considering, whether this relation could not be defined in our theoretical system. Some potentiality of qualification seems to be expressable by the following definition:

Df 3.14 $\quad \boldsymbol{qfb} = \{(x, y)\colon\ x, y \in \boldsymbol{Sgn} \ \wedge \bigvee_{u} \bigvee_{v} (u\ \boldsymbol{hfn} \cap \boldsymbol{hsgf}\ x \ \wedge\ v\ \boldsymbol{hfn} \cap \boldsymbol{hsgf}\ y \ \wedge\ u\ \boldsymbol{qf}\ v)\}$

Signs bound by the relation ***qf*** form a composite sign. The ***relation of binary qualificational sign composition*** (***bqsc***) will be introduced by the following definition:

Df 3.15 $\quad \boldsymbol{bqsc} = \{[(x, y), z]\colon\ x, y, z \in \boldsymbol{Sgn} \ \wedge\ x\ \boldsymbol{qf}\ y \ \wedge\ z = \mathbf{S}^{\text{‘}}\{x, y\}\}$

According to this definition, the qualificational composition of two signs x and y results in sign z, in symbols: $(x, y)\ \boldsymbol{bqsc}\ z$, iff x is qualified by y, and z proceeds from the mereological summation of x and y.

Since the relation ***bqsc*** is a function, formally:

3.1 $\quad \boldsymbol{bqsc}\colon\ (\boldsymbol{Sgn} \times \boldsymbol{Sgn}) \rightarrow \boldsymbol{Sgn},$

the symbol $\boldsymbol{bqsc}^{\text{‘}}(x, y)$ will be used to denote the unique sign z obtained by qualificational composition from signs x and y.

4. AXIOMATICS

It would be indecent to expect that a system of axioms devised for semantics could be less than rich. The vastitude of the semantic domain is overwhelming, and it cannot be projected upon a poor system of initial propositions.

The system of axioms proposed for our theory provides for 56 propositions which are divided into 8 groups. At first they will be given in a list, and subsequently their contents explained. These axioms thus characterize certain semantic objects by stating their properties explicitly. Some of these properties have already been informally referred to previously, in order to facilitate the understanding of the primitive terms. Now they will be expressed formally.

On the other hand, some of the axioms listed below have already been adduced elsewhere (cf. Bańczerowski 1997, 1998). Nevertheless, they will be repeated here for the sake of facilitating to form an idea of what a system of axioms for semantics should be like. Furthermore, the contents of certain axioms may seem obvious or overly simple. However, the construction of a formal theory requires that these simple and obvious contents be stated explicitly, in order to lay a firm foundation for deducing new contents, which may no longer be obvious.

4.1 The system of axioms

Ax 1 $\quad 0 < \mathrm{card}\,(\boldsymbol{Utr}) < \aleph_0$

Ax 2 $\quad \boldsymbol{Seg} \subset \mathbf{P} \langle\ \boldsymbol{Utr}$

Ax 3 $\quad 0 < \mathrm{card}(\boldsymbol{Seg}) < \aleph_0$

Ax 4 $\quad \boldsymbol{Sgn} \subset \boldsymbol{Seg}$

Ax 5 $\quad \boldsymbol{Utr} \subset \boldsymbol{Sgn}$

Ax 6 $\quad \boldsymbol{Sgft} \subset \mathfrak{Sgt}$

Ax 7 $\quad 1 < \mathrm{card}\,(\boldsymbol{Sgft}) < \aleph_0$

Ax 8 $\quad 1 < \mathrm{card}\,(\boldsymbol{DSE}) < \aleph_0$

Ax 9 $Sfhg \in \mathrm{aeq}\ (Sgft)$

Ax 10 $\sigma_i \in Sgft \rightarrow \bigvee_{\sigma_j} (\sigma_j \neq \sigma_i \wedge \sigma_i\ Sfhg\ \sigma_j)$

Ax 11 $hfn \in \mathrm{aeq}\ (Seg)$

Ax 12 $sg \subset Sgn \times Sgt$

Ax 13 $dsg: Sgn \rightarrow Dsgt$

Ax 14 $sgf \subset Sgn \times Sgft$

Ax 15 $dsb \subset Sgn \times Dsgt$

Ax 16 $sfb \subset Sgn \times Sgft$

Ax 17 $dsr: Dsgr \rightarrow \mathrm{pot}\ (Dsgt)$

Ax 18 $sgtz \subset Sgft \times Dsgt$

Ax 19 $lkf \subset sgf$

Ax 20 $smf \subset sgf$

Ax 21 $qf \subset Sgn \times Sgn$

Ax 22 $qfb \subset Sgn \times Sgn$

Ax 23 $x\ sg\ \sigma \rightarrow x\ dsg\ \sigma \vee x\ sgf\ \sigma$

Ax 24 $x \in Sgn \rightarrow sgf^{>}x \neq \emptyset$

Ax 25 $x \in Sgn \rightarrow \neg\, x\ dsg\ x$

Ax 26 $x\ dsg\ \sigma \rightarrow \neg\, x\ sgf\ \sigma$

Ax 27 $x \in Dsgr \rightarrow \bigwedge_{\sigma} [\sigma \in sgf^{>}x \rightarrow (dsg\,\text{‘}x \in sgtz^{>}\sigma \vee dsg\,\text{‘}x \in \mathrm{pot}(sgtz^{>}\sigma))]$

Ax 28 $\delta \in DSE \rightarrow \bigvee_{x} \bigvee_{y} (x, y \in Sgn \wedge (x, y)\ dsgf\ \delta)$

Ax 29 $\delta \in DSE \rightarrow \bigvee_{x} \bigvee_{y} (x, y \in Sgn \wedge \neg\, x\ hfn \cap hsgf\ y \wedge (x, y)\ isgf\ \delta)$

Ax 30 $x \in Sgn \rightarrow \bigvee_{y} (y \in Sgn \wedge y \neq x \wedge y\ hfn \cap hsgf\ x)$

Ax 31 $x \in Sgn \rightarrow \bigvee_{y} \bigvee_{\delta} (y \in Sgn \wedge \delta \in DSE \wedge (x, y)\ dsgf\ \delta)$

Ax 32 $x \in Sgn \rightarrow \bigvee_{y} \bigvee_{\delta} (y \in Sgn \wedge \delta \in DSE \wedge \neg\, x\ hfn \cap hsgf\ y \wedge (x, y)\ isgf\ \delta)$

Ax 33 $x\ dsg\ \sigma \rightarrow x\ dsb\ \sigma$

Ax 34 $x\ sgf\ \sigma \rightarrow x\ sfb\ \sigma$

Ax 35 $x \in Dsgr \rightarrow dsg\,\text{‘}x \in dsb^{>}x$

Ax 36 $x \in Sgfr \rightarrow sgf^{>}x \subset sfb^{>}x$

Ax 37 $dsb^{>}x \subset dsb^{>}y \leftrightarrow sgf^{>}y \subset sgf^{>}x$

Ax 38 $x\ dsb\ \sigma \rightarrow \bigvee_{y} (y\ sfb\ \sigma)$

Ax 39 $x\ sfb\ \sigma \rightarrow \bigvee_{y} (y\ dsb\ \sigma)$

Ax 40 $x \in Dsgr \rightarrow dsg\,\text{‘}x \in dsr\,\text{‘}x$

Ax 41 $x \in Dsgr \rightarrow dsr\,\text{‘}x \subset dsb^{>}x$

Ax 42 $x \in Dsgr \rightarrow (dsr\,\text{‘}x = \{dsg\,\text{‘}x\} \vee dsr\,\text{‘}x = dsb^{>}x)$

Ax 43 $dsb^{>}x = \{dsg\,\text{‘}x\} \rightarrow dsr\,\text{‘}x = \{dsg\,\text{‘}x\}$

Ax 44 $x \in Sgfr \rightarrow x \in Lkfr \cup Smfr$

Ax 45 $x \in Dsgr \rightarrow x \in Lkfr \cap Smfr$

Ax 46 $x\ smf\ \sigma \rightarrow \bigvee_{y} (y\ lkf\ \sigma)$

Ax 47 $x\ qf\ y \rightarrow x\ qfb\ y$

Ax 48 $x, y \in Dsgr \wedge x\ qf\ y \rightarrow dsb^{>}\,bqsc\,\text{‘}(x, y) \subset dsb^{>}x$

Ax 49 $x, y \in Dsgr \wedge x\ qf\ y \rightarrow sgf\,\text{‘}x \subset sgf^{>}\,bqsc\,\text{‘}(x, y)$

Ax 50 $x, y \in Dsgr \wedge x\ qf\ y \rightarrow dsg\,\text{‘}y \in sgf^{>}x$

Ax 51 $x, y \in Dsgr \wedge x\ qf\ y \rightarrow sgf^{>}y \subset sgf^{>}\,bqsc\,\text{‘}(x, y)$

Ax 52 $x, y \in Dsgr \wedge sgf^{>}x \subset sgf^{>}y \rightarrow \bigvee_{z} (z\ hlk\ x \wedge y\ qfb\ z)$

Ax 53 $x \in Dsgr \rightarrow \bigwedge_{\sigma} \{\sigma \in sgf^{>}x \wedge \bigvee_{y} [y\ dsg\ \sigma \rightarrow \bigvee_{z} (z\ hlk\ y \wedge x\ qfb\ z)]\}$

Ax 54 $x \in Smfr - Lkfr \rightarrow \bigvee_{y} (y \in Lkfr \wedge y\ qfb\ x)$

Ax 55 $x \in Lkfr - Smfr \rightarrow \bigvee_{y} (y \in Smfr \wedge x\ qfb\ y)$

Ax 56 $x \in Smfr - Lkfr \rightarrow \neg \bigvee_{y} (x\ qfb\ y)$

4.2 Explanation of axioms

The contents of the first 11 axioms are fairly general, and some of them should not be thought of as being limited to semantic theories.

Axiom 1 states that the set of all utterances is finite and non-zero. In other words, the number of its elements is more than 0, and at the same time less than the power of the set of all natural numbers. According to axiom 2, linguistically relevant segments are but parts, in a mereological sense, of utterances, and axiom 3 adds that the set of all these segments is also finite and non-zero. Signs are but a kind of segment, in light of axiom 4. Consequently, the set of all signs must be finite as well. Formally:

4.1 $\quad \mathrm{card}\,(\boldsymbol{Sgn}) < \aleph_0$

Utterances can be viewed as kinds of signs, and this is stated by axiom 5. According to axiom 6, significata (meanings) form a subset of signata, that is, of extralingual entities, and in light of axiom 7 the set of significata is finite and non-zero. The same property is also displayed by the set of all semantic dimensions, which is the content of axiom 8. According to axiom 9, the relation of significative homogeneity is an equivalence on the set of all significata, and axiom 10 requires that each significatum σ_i has a homogenic counterpart, different from σ_i. In light of axiom 11, the relation of homophony appears as an equivalence on the set of all segments.

Axioms 12-22 characterize 11 relations by specifying their domains and converse domains. The contents of these axioms are clear and need no further elucidation. Neverthess, let us emphasize, that the relation ***sg*** binds the universe of signs with the universe of extralingnal entities. A signal becomes a sign, if it signates some such entity. Formally:

4.2 $\quad x \in \boldsymbol{Sgn} \rightarrow \bigvee_{\sigma} (x\, \boldsymbol{sg}\, \sigma)$

Furthermore, two of the considered relations, that is, ***dsg*** and ***dsr***, turn out to be functions.

Axiom 23 formally states that signation may happen in two modes, by either designation or signification. The following two corollaries may be inferred:

4.3 $\quad \boldsymbol{dsg} \subset \boldsymbol{sg}$
4.4 $\quad \boldsymbol{sgf} \subset \boldsymbol{sg}$

Thus, both designation and signification appear only as subrelations of signation. And, consequently, a sign may be a designator or significator, and a signatum may be designatum or significatum.

In light of axiom 24, every sign must signify, that is, every sign must be a significator. The content of this axiom may seem at first sight controversial, especially if proper names or demonstrative pronouns are considered. However, it is not antiintuitive. Proper names may signify Gender, Animateness, or other meanings. Similarly, demonstrative pronouns may signify Gender (cf. Latin *is, ea, id*), Distance (cf. *this* vs *that*), or Person (cf. Japanese *kore* 'this by me', *sore* 'that by you', *are* 'that by the 3rd. Person'). As a consequence the following theorem may be deduced:

4.5 $\quad x \in \boldsymbol{Dsgr} \rightarrow x \in \boldsymbol{Sgfr}$

Thus, every designator is at the same time a significator. It even seems appropriate to say that in order to designate a sign must signify sufficiently, that is, it must convey sufficient meaning. In other words, if the properties of the target designatum are not sufficiently indicated by the sign, it cannot be designated, because it may not be sufficiently delineated from other objects. And, what is more, incompatible meannings lead to vacuous designation. Designation is thus dependent upon signification, and perhaps the former is definable in terms of the latter. Let us still adduce the following corollaries:

4.6 $\quad x\, \boldsymbol{Dsgr} \rightarrow \boldsymbol{sgf}^{>}x \neq \varnothing$

4.7 $\quad x\, \boldsymbol{dsg}\, \sigma_i \rightarrow \bigvee_{\sigma_j} [x\, \boldsymbol{sgf}\, \sigma_j \wedge (\sigma_i \in \boldsymbol{sgtz}^{>}\sigma_j \vee \sigma_i \subset \mathrm{pot}(\boldsymbol{sgtz}^{>}\sigma_j))]$

According to axiom 25, no sign can designate itself. We are aware that this statement may be unacceptable for some semanticists.

Axiom 26 states that, if σ is designated by sign x, then it cannot be at the same time signified by x. Whether the property described by this axiom is peculiar to all designators should be investigated further. The possibility cannot be excluded that the range of this axiom will require appropriate restriction. In any case, words and word-phrases seem to comply to its content. The following corollary may be inferred:

4.8 $\quad x\, \boldsymbol{sgf}\, \sigma \rightarrow \neg\, x\, \boldsymbol{dsg}\, \sigma$

The intuitive sense of axiom 27 can be explained as follows. If sign x is a designator, then its designatum is either an element of each significative category specified by each meaning of x or it is an element of the powerset of each such category.

If significata can be conceived of as mereological wholes, this axiom could be reformulated to assume the following shape:

Ax 27′ $\quad x \in \boldsymbol{Dsgr} \rightarrow \bigwedge_{\sigma} [\sigma \in \boldsymbol{sgf}^{>}x \rightarrow (\boldsymbol{dsg}\text{‘}x \in \mathbf{P}^{<}\sigma \vee \mathbf{S}\text{‘}\boldsymbol{dsg}\text{‘}x \in \mathbf{P}^{<}\sigma)]$

Axioms 28 and 29 require, that each semantic dimension be represented by both dissignificative and isosignificative signs, respectively.

In light of axiom 30, each sign as a non-recurrent object must be obligatorily reproducible. In other words, linguators must be able to produce signs, which are homophonous and homosignificative with each particular sign. The irreproducibility of signs is virtually impossible.

Axiom 31 requires, that each sign be dissignificative with some other sign at least in one semantic dimension, and axiom 32 requires that each sign be isosignificative with some other sign at least in one semantic dimension.

Axioms 33-39 state some of the interdependences between the relations ***dsg***, ***dsb***, ***sgf***, and ***sfb***. Thus, axioms 33 and 34 say that designation presupposes designatability, and signification – signifiability, respectively. According to axiom 35, the designatum of each designator belongs to its designative extension, and according to axiom 36, the significatum of each significator is included in (or perhaps identical with) its significative extension. Axiom 37 states an inverse inclusion between the designative extensions of two signs and their total meanings. The validity of the last two axioms in this group, that is 38 and 39, may again appear as highly controversial. They should reflect important interdependences between designation and signification. Namely, if entity σ is designatable by a sign, then it also is signifiable by some other sign, and if entity σ is signifiable by a sign, then it also is designatable by some other sign. As a consequence of axiom 38 the following corollary can be derived:

4.9 $x \in \boldsymbol{Sgfr} \rightarrow \bigwedge_{\sigma} [\sigma \in \boldsymbol{sgf}^{>}x \rightarrow \bigvee_{y} (y\ \boldsymbol{dsb}\ \sigma)]$

Axioms 40-43 outline various interdependences between the relations ***dsg***, ***dsb***, and ***dsr***. In particular, axiom 40 says that the designatum of sign x is an element of the designative range of x, and axiom 41 adds that the designative range of x is included in the designative extension of x. According to axiom 42, the designative range of x is identical either with $\{\boldsymbol{dsg}`x\}$ or with the designative extension of x. And, according to axiom 43, if the designative extension of x has as its only element the designatum of x, then the same is true of the designative range of x, that is, it also has as its only element the designatum of x.

Axioms 44-45 characterize significators and designators, respectively, in terms of lexification and semification. In light of axiom 44, every significator is either a lexificator or semificator, whence the following implications can be inferred:

4.10 $x\ \boldsymbol{sgf}\ \sigma \rightarrow x\ \boldsymbol{lkf}\ \sigma \vee x\ \boldsymbol{smf}\ \sigma$

4.11 $\sigma \in \boldsymbol{Sgft} \rightarrow \sigma \in \boldsymbol{Lkft} \vee \sigma \in \boldsymbol{Smft}$

And, in light of axiom 45, every designator is both a lexificator and semificator. The following theorems can be derived:

4.12 $x \in \boldsymbol{Lkfr} - \boldsymbol{Smfr} \rightarrow x \notin \boldsymbol{Dsgr}$

4.13 $x \in \boldsymbol{Smfr} - \boldsymbol{Lkfr} \rightarrow x \notin \boldsymbol{Dsgr}$

4.14 $x \in \boldsymbol{Dsgr} \rightarrow x \notin \boldsymbol{Lkfr} - \boldsymbol{Smfr} \wedge x \notin \boldsymbol{Smfr} - \boldsymbol{Lkfr}$

In light of these theorems, neither pure lexificators nor pure semificators can occur as designators. Pure significators are thus linguistic units rather than lingual units.

Axiom 46 states that the occurrence of semification of entity σ by sign x, presupposes the existence of sign y which lexifies σ. We could also say that the semifiability of σ presupposes its lexifiability. Formally:

4.15 $x\ \boldsymbol{smfb}\ \sigma \rightarrow x\ \boldsymbol{lkfb}\ \sigma$

The claim made by this axiom may also seem controversial, a fate it shares with a few others here.

Axioms 47-53 concern some properties of sign composition based on the relation of qualification. According to axiom 47 qualification presupposes qualifiability. Axiom 48 says that the designative extension of a sign resulting from the composition of two designators bound by the relation ***qf*** is included in the designative extension of that constituent designator, which functions as qualificatum. In other words, the designative extension of a composite sign (syntagma) is smaller than the designative extension of its constituent appearing in the status of qualificatum. Qualificators thus restrict the designative extension of their corresponding qualificata. Axiom 49, in turn, says that the total meaning of a designator qualified by another designator is included in the total meaning of the sign resulting from the composition of these two designators. Thus, the meaning of the composite sign (syntagma) is richer, than the meaning of that constituent which appears in the status of qualificatum. Qualificators thus expand the meaning of their corresponding qualificata. The intuitive sense of axiom 50 may seem difficult to accept in that it states, that the designatum of a qualificator becomes a meaning of its qualificatum. Thus, the designator, which at the same time is a qualificator becomes a significator with respect to its qualificatum. And, axiom 51 adds that the total meaning of a qualificator is included in the total meaning of the sign resulting from the composition of this qualificator with its qualificatum. In light of axiom 52, the inclusion of the total meaning of sign x in the total meaning of sign y presupposes the existence of sign z, which is homolexical with x, and by which y is qualifiable. In accordance with this axiom, a sign is qualifiable by another sign, which is homolecxical with the hyperonym of the former. Thus, for example, the phrase *is a bird* is homolexical with the phrase *a bird*, which, in turn, is a hyperonym of *a raven*. Consequently, *a raven* is qualifiable by *is a bird*.

Axiom 53 goes still further than the preceding one by stating that designator x is qualifiable by designator z, which is homolexical with y designating arbitrary meaning of x. Expressing this differently, it could be said that designator z, which is homolexical with y designating arbitrary meaning of designator x, can qualify x.

The last three axioms, 54-56, elucidate the relationship between lexificators and semificators in terms of qualifiability.

Axiom 54 presupposes the existence of a lexificator for each pure semificator, and such that the former is qualifiable by the latter. Pure semificators then require corresponding lexificators.

Axiom 55, in turn, presupposes the existence of a semificator for each pure lexificator, such that the latter is qualifiable by the former. Thus, pure lexificators also require the corresponding semificators.

And, in light of the last axiom, no pure semificator is further qualifiable. As a consequence of this axiom the following corollary can be derived:

4.16 $x\ \boldsymbol{qf}\ y \rightarrow x \notin \boldsymbol{Smfr} - \boldsymbol{Lkfr}$

Although the system of axioms as presented above is relatively rich, it does not yet seem to be fully complete. Further, the author has not always managed to convert adequately his intuitions into axiomatic formulations. Nevertheless, he has allowed himself to propose for consideration this still deficient system in the hope that further discussion may contribute to the perfection of the formal shapes and the contents of the axioms therein and thereby advance our knowledge of semantics.

On closer inspection, some of the axioms may turn out to be theorems. But this would not be regrettable at all. On the contrary, the insufficient exemplification of some axioms may not adequately facilitate a correct understanding of their contents, and this is already regrettable.

In short, the system of axioms considered here, should be viewed as a modest proposal for the axiomatization of a semantic theory rather than an already mature result.

5. CONCLUDING REMARKS

The tentative version of a semantic theory outlined above resulted thus from the decision of the author to stop pondering the question of whether semantics is axiomatically accessible or not, and instead to offer a theoretical system, which, preliminary as it may be, can serve as a basis for further inquiry. Whether this version already is a convincing answer to the question posed by the title, by virtue of its formally capturing relevant semantic problems, must for the time being remain undecided. Uncertain is thus whether this theory is an adequate description at least of a fragment of the semasy of natural language. Nevertheless, we console ourselves that, if it is not contradictory, it may describe a fragment of some virtual language.

The propositional content of an axiomatic theory finds reflection in its system of axioms and their consequences. The latter are simply theorems deduced from the former. However, our intention was not to show the deductive potential of our theory here. First and foremost, we confined ourselves to the presentation of primitive terms and axioms, and only occasionally adducing some theorems. Let us also add that this theory lends itself to development in various directions, including lexical semantics, grammatical categories, sentential semantics, etc. Needless to say, such elaboration would require us to expand the axiomatics accordingly.

Arriving at the end of these semantic quandaries, the author, soliciting no excuses for any possible deficiencies in his theory, would however like to state that he is unable to say exactly to what degree he is its conscious creator. During its formulation he could not resist the impression, that after the initial phase the theory itself seemed to guide him or even to take over the course of its own creation, even to the extent that some primitive terms had to be added and some axioms changed. Therefore its final shape and contents differ considerably from those intended at the outset. Or, perhaps, this is an illusion?

Notes

The meaning of the logical terms utilized in this paper will be explained as follows. The propositional connectives of *negation*, *conjunction*, *disjunction*, *implication* and *equivalence* will be denoted, respectively, by the symbols: $\neg$, $\wedge$, $\vee$, $\rightarrow$, $\leftrightarrow$. The universal quantifier *for every* (*all*) *x* and the existential quantifier *there is* (*exists*) *an x such that*, which bind a variable *x*, are abbreviated, respectively, with the symbols $\bigwedge_x$ and $\bigvee_x$. The symbol $\dot{\bigvee}_x$ is reserved for the phrase *there is exactly one x such that*. The symbols = and $\neq$ will denote, respectively, *identity* and *diversity*.

The set, the elements of which are *x, y, z, ...* will be denoted by $\{x, y, z, \ldots\}$. Thus $X = \{x, y, z, \ldots\}$ means that *x, y, z* are elements of the set *X*. The formula $x \in X$ reads: *x* belongs to *X*, or *x* is an element of *X*. The formula $x \notin X$ reads: *x* does not belong to *X*. The *inclusion* of a set *X* in a set *Y* will be written as $X \subset Y$. The *empty set* is denoted by $\varnothing$. The symbol $\{x\}$ denotes the set containing a single element, namely, the object *x*. A set, the elements of which are sets, will be called a *family of sets*. The set of all subsets of a set *X* is called the *power set* of *X* and is denoted by pot(X). The symbol card(X) stands for the *cardinal number* or *power* of a set *X*, and it reveals how many elements the set *X* contains. There are finite and infinite sets. The set of all natural numbers $\mathcal{N}$ is infinite, and the number of its elements is symbolized by $\aleph_0$. The inequality card$(X) < \aleph_0$ always indicates that *X* is finite. The operations of *sum*, *intersection*, *difference*, and *Cartesian product*, defined on two sets *X* and *Y*, will be symbolized, respectively, as $X \cup Y$, $X \cap Y$, $X - Y$, and $X \times Y$. The symbols $\bigcup\mathcal{X}$ and $\bigcap\mathcal{X}$ will designate, respectively, the sum and the intersection of a family $\mathcal{X}$ of sets.

The Cartesian product $X \times Y$ of two sets *X* and *Y* is the set of all ordered pairs (x, y) with $x \in X$ and $y \in Y$. The subsets of $X \times Y$, where *X* and *Y* are any sets will be called *binary relations* in the product $X \times Y$. The fact that *R* is a binary relation in $X \times Y$ will be expressed in the form $R \subset X \times Y$. In order to state that *x* bears the relation *R* to *y* we shall write $x\ R\ y$ or, alternatively, $(x, y) \in R$ or $R(x, y)$.

The *image of an element x* under the relation *R*, i.e. the set of all successors of *x* in the ordered pairs $(x, y) \in R$ will be denoted by $R^{>}x$, and the *converse image of an element x* under the relation *R*, i.e. the set of all predecessors of *x* in the ordered pairs $(y, x) \in R$ will be denoted by $R^{<}x$. The set $R\rangle X$ is called the *image of a set X* given by the relation *R*. It contains those objects *y* which are successors in the pairs $(x, y) \in R$, where $x \in X$. The set $R\langle X$ is called the *converse image of a set X* given by the relation *R*. It contains those objects *y* which are predecessors in the pairs $(y, x) \in R$, where $x \in X$.

A relation which is *reflexive* and *symmetric* will be called a *similarity* relation. If a relation is moreover *transitive*, it will be called an *equivalence* relation. The set of all similarity relations on a set *X* will be denoted by sim(X), and the set of all equivalence relations on *X* by acq(X). Any similarity relation on a set *X* specifies a corresponding *similarity-classification* of *X*, and any equivalence relation on *X* specifies a corresponding *equivalence-classification* of *X*. The *family of all similarity-classifications of a set X* will be designated by clfsim(X), and the *family of all equivalence-classifications of X* by clfeq(X). If

X is a set and R a similarity relation on X, then the similarity-classification of X induced by R will be symbolized by $X//R$. And, analogously, if X is a set and R an equivalence relation on X, then the equivalence-classification of X induced by R will be symbolized by X/R.

A relation $R \subset X \times Y$ is called a function from X to Y, if for every $x \in X$ there is exactly one $y \in Y$ such that $x\ R\ y$. The expression $R: X \rightarrow Y$ always means that R is a function from X to Y. The unique element $y \in Y$ which is associated with an element $x \in X$ under the function R will be designated by $R‘x$.

Besides purely logical terms, three mereological ones will also be used. These are the *relation of being a part of*, the *relation of mereological sum*, and the *relation of precedence in time*, which will be denoted, respectively, by the symbols **P**, **S**, and **T**. The formula $x\ \mathbf{P}\ y$ means that an object x is a part of an object y. The relation **P** is reflexive, antisymmetric, and transitive. The formula $y\ \mathbf{S}\ X$ means that y is the whole composed of all and only of the elements of the set X. Since the relation **S** is a function, this unique whole will be denoted as $\mathbf{S}‘X$. In particular, the whole resulting from the mereological summation of two objects x and y will be denoted as $\mathbf{S}‘\{x, y\}$ or $x \overset{m}{\cup} y$. The mereological intersection of two such objects will be denoted as $x \underset{m}{\cap} y$. And, finally, the formula $x\mathbf{T}y$ means either that the whole object x precedes the whole object y in time, or that the last slice of x coincides in time with the first time slice of y (cf. Batóg 1967: 17ff).

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