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AN AXIOMATIC APPROACH TO THE GENERAL THEORY OF COMPOUNDS

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The aim of this article is to provide a logical reconstruction of the general theory of compounding. The theory formulated here is partly based on the axiomatic approach to general morphology presented in BAŃCZEROWSKI (1997) and it can be conceived of as its continuation.
As a point of departure for the present investigation a set of primitive terms is constructed and axioms formulated, followed by basic definitions and theorems. Then the authors introduce discrete dimensions making it possible to describe morphological, syntactic and semantic properties of compound words. The analyses of the dimensions lead to various structural classifications of the compound words.

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INTRODUCTION

This study will be devoted to providing an axiomatic approach to the general theory of compounds. The theory is primarily based on Indo-European empirical data, but it can be applied to other ethnic languages as well. The main idea, which underlies all the research, is to attempt to elaborate an overall description of the morphological structure and syntactic properties of compounds by means of logical apparatus that combine both ancient and contemporary approaches to compounds.

To begin, the logical apparatus used to express linguistic terms will be discussed, then the primitive terms and axioms will be given and explained. The next sections are devoted to analyzing and axiomatically reconstructing the compound types, and introducing the dimensions used to characterize the semantics, syntactic structure and properties of compound constituents and the susceptibility of compound constituents to semical flexion.

1. FORMAL PRELIMINARIES

In this paragraph all formal terms with their notations will be given.

The symbols: $\neg$, $\wedge$, $\vee$, $\rightarrow$, $\leftrightarrow$ denote *negation*, *conjunction*, *disjunction*, *implication* and *equivalence* respectively.

The symbols $\bigwedge_x$ and $\bigvee_x$ denote the universal quantifier *for every* (*all*) *x* and the existential quantifier *there is* (*exists*) *an x such that*, which bind a variable *x*.

Identity is denoted by the symbol =, and distinctness by ≠.

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*. Instead of writing $x \in X$ and $y \in X$, the formula $x, y \in X$ will be used. The set whose elements are *x, y, z, …* is denoted by $\{x, y, z, \ldots\}$. The *empty set* is denoted by $\varnothing$.

If *X* and *Y* are sets, then
the sum is denoted by the symbols $X \cup Y = \{x: x \in X \vee x \in Y\}$;
the product $X \cap Y = \{x: x \in X \wedge x \in Y\}$;
the difference $X - Y = \{x: x \in X \wedge x \notin Y\}$;
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 $y \in Y$.

If the product of sets is an empty set, the sets are disjoint.

If *X is a subset of Y* or in other words *X is included in Y* it will be symbolically written as $X \subseteq Y$.

Two subsets are identical if they have the same elements. If $X \subseteq Y$ and $Y \subseteq X$, then $X = Y$. If $X \subseteq Y$ and $X \neq Y$, then *X* is a proper subset of *Y* (there is a proper inclusion between *X* and *Y*). The symbol card(*X*) means the cardinal number or cardinality of *X*, which determines the number of elements of X. Sets can be finite and infinite. The set of all natural numbers *N* is infinite. The number of its elements is expressed by the symbol $\aleph_{0.}$ The inequality card(X) < $\aleph_0$ always means that the set *X* is finite.

If $R \subseteq X{\times}Y$, then *R* is a binary relation between the elements of the sets *X* and *Y*. The formula that *x* is bound by the relation *R* with *y* can be formally written as $x\ R\ y$ or $(x, y) \in R$; *x* is called a predecessor of the relation *R* and *y* a successor of the relation *R*.

The set of all predecessors of a relation is its domain, and the set of all successors of the relation is its converse domain. If $R \subseteq X{\times}Y$ and *x* are predecessors of *R* and *y is* a successor, the domain is denoted as $R^{<}x$, and the converse domain as $R^{>}x$. The set $R \rangle X$ is called the image of set *X* given the relation *R*. The image of set *X* contains the elements y which are predecessors in the pairs $(y, x) \in R$ where $x \in X$. The set $R \langle X$ is called a converse image of set *Z* given by the relation *R*. The converse image of set *Z* contains the elements y which are the predecessors in the pairs $(y, x) \in R$ where $x \in X$.

A binary relation is:
1. reflexive, if $x\ R\ x$ for all $x \in X$;
2. symmetric, if for any $x, y \in X$, $x\ R\ y$ implies $y\ R\ x$;
3. transitive, if for any $x, y, z \in X$, $x\ R\ y$ and $y\ R\ z$ implies $x\ R\ z$;
4. antisymmetric, if for any $x, y \in X$, $x\ R\ y$ and $y\ R\ x$ implies $x = y$;
5. antireflexive, if $x\ R\ x$ occurs for no $x \in X$.

A reflexive, symmetric and transitive relation is called an equivalence relation, and a reflexive and symmetric relation is called a similarity relation. The set of all equivalence relations in the set *X* is expressed by the symbol *aeq*(*x*). An equivalence relation on the set *X* specifies a classification of the set X. If *R* is an equivalence relation on *X*, the classification of the set *X* induced by *R* is formally denoted by *X/R*.

Moreover, two primitive mereological terms need to be introduced:
the relation of precedence in time (the formula x **T** y is read “a whole object x precedes in time a whole object y or a beginning of the object x coincides in time with an end of the object y in time”) and the relation of being a part of (the formula x **P** y means that an object x is a part of an object y).

The following terms are definable:

a) a mereological sum **S** – x is a mereological sum of a set of objects X, symbolically $x = \mathbf{S}(X)$, iff all objects belonging to X are parts of x and each part of the object x has a common part with an element of the set X.

b) a relation of total precedence in time $\mathbf{T_c}$ (an object x totally precedes in time a object y, iff no part of the object y precedes in time any part of the object x).

c) a relation of direct precedence in time $\mathbf{T_{imd}}$ – an object x directly precedes in time an object y, symbolically $x\mathbf{T_{imd}}\,y$, iff an object x totally precedes in time the object y and there does not simultaneously exist any object z which totally precedes in time the object y (Bańczerowski et al. 1982: 106; Pogonowski 1991b: 7–11; Batóg 1994: 19–22).

2. PRIMITIVE TERMS AND AXIOMS

The set of primitive terms consists of:

Seg – the set of all significant language segments;
hfn – the relation of homophony;
Dct – the set of all dictons;
Stg – the set of all syntagms;
dsg – the relation of designation;
sgf – the relation of signification;
lkf – the relation of lexicalization;
smf – the relation of semification;
hpn – the relation of hyponymy;
hlk – the relation of homolexy;
mfq – the relation of morphological qualification;
cpl – the relation of morphological copulativity;
Ps – the set of parts of speech
Cas – the set of all case dictons

Among language segments one can distinguish phonons (actual phones), morphons (actual morphs), vocabulons (actual minimal lexical units), dictons (actual words). The set of all language segments is expressed by the symbol ***Seg***, and the formula $x \in$ ***Seg*** means that x is a language segment. The set of all language segments is always finite.

Ax. 1 $0 < \mathrm{card}(\boldsymbol{Seg}) < \aleph$.

The relation of homophony ***hfn*** binds such language segments which are auditively indistinguishable. The relation of homophony is an equivalence relation on the set of language segments.

Ax. 2 $\boldsymbol{hfn} \in \mathrm{aeq}(\boldsymbol{Seg})$.

A dicton is a concrete, unrepeatable kind of language segment which functions as a linearly continual or discontinual language sign conveying lexical and semic meaning.

Ax. 3 $\boldsymbol{Dct} \subset \boldsymbol{Seg}$

The set of all dictons is expressed by the symbol ***Dct*** and $x \in \boldsymbol{Dct}$ means that *x* is a dicton.

A morphaton is the main constituent of the dicton. The set of all morphatons is denoted by the symbol ***Mof***, $x \in \boldsymbol{Mof}$ means that x is a morphaton.

The syntagm is interpreted here as a language segment consisting of at least two dictons.

Obviously, each pair or group of dictons may not always satisfy the condition of being a syntagm, e.g. *mały samochód*, *idzie do pracy*, *kupuje dużo owoców* are Polish syntagms but *on samochód*, *praca dużo*, *mały pisać* do not satisfy the condition of being a Polish syntagm. The set of all syntagms is expressed by the symbol ***Stg*** and the formula $x \in \boldsymbol{Stg}$ means that *x* is a syntagm (cf. Bańczerowski 1980: 38). — no syntagm can simultaneously be a dicton.

Ax. 4 $x \in \boldsymbol{Stg} \rightarrow \neg\, x \in \boldsymbol{Dct}$

In turn the relation of designation binds language expressions with the extra-language reality. The language expressions are understood as "something" and the relation of **signification** is understood as a "value or quality". The formula $x\ \boldsymbol{dsg}\ \delta$ is read as *x* designates *s*; the predecessor of the relation is called ***designator***, and its successor ***designatum***.
The formula $x\ \boldsymbol{sgf}\ s$ is read *x* signifies s or *x* conveys the meaning *s* – the predecessor of the relation is called ***significator*** and its successor ***significatum***.

The relations of lexification ***lkf*** and semification ***smf*** are special types of ***signification***, which express the conviction that the meaning can be conveyed both in lexical and semic ways. The formula $x\ \boldsymbol{lkf}\ \sigma$ is read *x* lexifies meaning σ or *x* is a lexificator of σ. Analogously, the formula $x\ \boldsymbol{smf}\ \sigma$ is read *x* semifies meaning σ or *x* is a semificator of σ. Each dicton both lexifies and semifies meanings and the number of the lexificators in the dicton has to be greater than or equal to 1.

Ax. 5 $x \in \boldsymbol{Dct} \rightarrow \boldsymbol{lkf}^{>} x \neq \varnothing \wedge \boldsymbol{smf}^{>} x \neq \varnothing$

Ax. 6 $x \in \boldsymbol{Dct} \rightarrow \mathrm{card}\,(\boldsymbol{lkf}^{>} x) \geq 1$

The etymologically related and semantically indistinguishable language segments, which lexify, are bound by the relation of homolexy. The formula $x\ \boldsymbol{hlk}\ y$ means that *x* and *y* are considered homosignificative.

The relation of hyponymy binds two dictons. One of them is semantically subordinate to the other. The formula $x\ \boldsymbol{hpn}$ y means the dicton *x* is semantically subordinate to the dicton *y*. The predecessor of the relation is called **hyponym** and the successor **hyperonym**.

Two types of hyponymy can be considered: proper and not-proper. The first one is transitive irreflexive (no lexeme is subordinate to itself) and the second one is transitive and reflexive (each lexeme is subordinate to itself). In this respect, ***hpn*** is a relation of not-proper hyponymy (cf. Pogonowski 1991b: 20):

Ax. 7 $x\ \boldsymbol{hpn}\ y \wedge y\ \boldsymbol{hpn}\ z \rightarrow x\ \boldsymbol{hpn}\ z$

Ax. 8 $x \in \boldsymbol{Dct} \rightarrow x\ \boldsymbol{hpn}\ x$

If two dictons are mutual hyponyms, they are synonymous:

Ax. 9 $x\ \boldsymbol{hpn}\ y \wedge y\ \boldsymbol{hpn}\ x \rightarrow x\ \boldsymbol{hlk}\ y \wedge x\ \boldsymbol{hfn}\ y$.

The relation of morphological qualification ***mfq*** binds two morphatons in such a way that x is determined and the other is a determinator. The formula *x* ***mfq*** *y* means: *x* is qualified by *y* or *y* qualifies *x*. The predecessor of the relation is called **qualificatum** and the successor **qualificator**. The axioms given below express the general properties of the relation ***mfq*** which is irreflexive, intransitive, asymmetric and antisymmetric.

Ax. 10 $\boldsymbol{mfq} \subset \boldsymbol{Mof} \times \boldsymbol{Mof}$

Ax. 11 $x\ \boldsymbol{mfq}\ y \rightarrow x \neq y$

Ax. 12 $x\ \boldsymbol{mfq}\ y \rightarrow \neg\, y\ \boldsymbol{mfq}\ x$

Ax. 13 $x\ \boldsymbol{mfq}\ y \wedge y\ \boldsymbol{mfq}\ z \rightarrow \neg\, x\ \boldsymbol{mfq}\ z$

Ax. 14 $x\ \boldsymbol{mfq}\ y \wedge y\ \boldsymbol{mfq}\ z \rightarrow x = y$ (Bańczerowski 1997a: 27)

The relation of copulativity ***cpl*** binds morphatons in a paratactic way – the formula *x* ***cpl*** *y* means: *x* is coordinate to *y*. The relation is indicated in a word-formation paraphrase by a linking word "and" (Bańczerowski 1997a: 15–18). The relation ***cpl*** is reflexive, symmetric and transitive.

Ax. 15 $\boldsymbol{cpl} \in \mathrm{aeq}(\boldsymbol{Mof})$

Two morphatons can be bound by only one type of relation – the relations ***mfq*** and ***cpl*** exclude each other.

Ax. 16 $x\ \boldsymbol{mfq}\ y \rightarrow \neg\, x\ \boldsymbol{cpl}\ y$.

The sets of case dictons ***Cas*** and parts-of-speech dictons ***Ps*** belong to the primitive terms. It goes without saying that each and every dicton must belong to ***Ps*** since in the majority of the languages of the world any dicton should belong to ***Ps***. Another property of case dictons is that they should convey at least one semical meaning.

Ax. 17 $x \in \boldsymbol{Cas} \rightarrow x \in \boldsymbol{Ps}$

Ax. 18 $x \in \boldsymbol{Cas} \rightarrow \mathrm{card}\ (\boldsymbol{smf}^{>} x) \geq 1$

3. DEFINABLE MORPHOLOGICAL UNITS SMALLER THAN A COMPOUND AND RELATIONS

It is a complicated task to construct a proper compound definition on which the whole compounding theory should be based. To describe a compound which is a complex morphological structure one should introduce auxiliary terms for smaller morphological units than compounds.

The set of all morphatons has been included in the set of primitive terms. The relation of *being a morphaton of* is defined as follows:

Def. 1 $\boldsymbol{mf} = \{(x,y):\ y \in \boldsymbol{Dct} \wedge\ x \in \boldsymbol{Seg}^{<} y\}$

"According to this definition, *x* is a morphaton of dicton *y*, in symbols: *x* ***mf*** *y*, iff *x* is a constituent segment of *y*" (Bańczerowski 1997a: 19).

In the compound φερανθής, the following morphatons can be distinguished: φερ-, -ανθής, φερανθ-,-ανθ-,-ής.

The smallest morphological unit is a morphon – a minimal meaning conveyor.

This term is introduced within the relation of *being a morphon of*:

Def. 2 $\boldsymbol{mr} = \{(x,y):\ y \in \boldsymbol{Dct} \wedge x \in \boldsymbol{mf}^{<} y \ \wedge \bigvee_{\sigma} [\sigma \in \boldsymbol{sgf}^{>} y \wedge \sigma \in \boldsymbol{sgf}^{>} x \ \wedge$

$\bigvee_{z} (z \in \boldsymbol{sgm}^{<} x \wedge z \neq x \rightarrow \sigma \notin \boldsymbol{sgf}^{>} z)]\}$

According to this definition *x* is a morphon of a dicton y if it is a minimal significator of σ and there is no subsegment of *x* that can be a significator of σ (cf. Bańczerowski 1997: 20).

In the compound φερανθής 'flower bringing' the following morphons can be distinguished: φερ-, -ανθ- and -ης.

The morphons can conjoin themselves into larger units which are called morphotactons. The relation of *being a morphotacton of* (***mt***) is introduced on the basis of the following definition:

Def. 3 $\boldsymbol{mt} = \{(x, y): y \in \boldsymbol{Dct} \wedge x \in \boldsymbol{mf}^{<} y \wedge \mathrm{card}(\boldsymbol{mf}^{<} x) > 1\}$

Thus, the morphotacton is a special kind of morphaton built of at least two morphons.

The set of morphotactons is defined as follows:

Def. 4 $\boldsymbol{Mot} = \boldsymbol{mt} \langle \boldsymbol{Dct}$

(cf. Bańczerowski 1997a: 22).

In the compound φερανθής, there are the following morphotactons: -ανθής.

As is presented above, the morphological units within dictons can be distinguished in terms of the level of their complexity.

There are two types of relations between the morphological units: the relation of morphatonal qualification ***mfq*** and the relation of morphatonal copulativity. Both of them belong to the primitive terms. If the relations are confined to the morphons, they are represented by the relation of morphonal qualification ***mrq*** and copulativity ***mrc***:

Def. 5 $\boldsymbol{mrq} = \{(x, y): x, y \in \boldsymbol{Mor} \wedge x\ \boldsymbol{mfq}\ y\}$

Def. 6 $\boldsymbol{mrc} = \{(x, y): x, y \in \boldsymbol{Mor} \wedge x\ \boldsymbol{cpl}\ y\}$

A morphotacton is constructed as a result of an operation which combines a certain set of morphatons. Formally, the operation called morphotactonification is introduced by the following definition:

Def. 7 $\boldsymbol{mtf} = \{[(x, y), z]:\ z \in \boldsymbol{Mot} \ \wedge\ x, y \in \boldsymbol{mf}^{<} z \ \wedge\ x \ \boldsymbol{mfq} \ y \ \wedge\ \mathbf{S'}(x, y) = z\}$

"In light of this definition, two morphatons *x* and *y* combine to form morphotacton *z* or, equivalently, *x* and *y* morphotactify to *z*, in symbols: (*x*,*y*) ***mtf*** *z*, iff *x* is qualified by *y*, and *x* and *y* completely exhaust *z*" (Bańczerowski 1997a: 23).

The morphotactons can be divided into qualificators and qualificata in terms of their qualificational status. The terms are introduced within the *relation of having the maximal qualificatum* and *the relation of having the maximal qualificator*.

Def. 8 $\boldsymbol{mfqm} = \{(x, y) : \bigvee_{x}(y \ \boldsymbol{mfq} \ z \wedge \boldsymbol{mtf'}(y, z) = x)\}$

Def. 9 $\boldsymbol{mfqr} = \{(x, y) : \bigvee_{x}(z \ \boldsymbol{mfq} \ y \wedge \boldsymbol{mtf'}(z, y) = x)\}$

"According to definition 8, morphotacton *x* has morphaton *y* as its maximal qualificatum, in symbols: *x* ***mfqm*** *y*, iff there is morphaton *z* which qualifies *y*, and such that the combination of *y* and *z* results in *x*. The content of definition 9 is *mutatis mutandis* analogous" (Bańczerowski 1997a: 24).

In the compound *bawidamek* 'ladies' man', the maximal qualificatum is *bawi-* or *bawidam-*, the maximal qualificator is *-damek* or *-ek*.

In turn, there are morphonal qualificata intiale and morphonal qualificators ultima in the determinational structure of dictons based on the relation of morphonal qualification.

The terms are introduced on the basis of the relation of *having the morphonal qualificatum intiale* and the relation of *having the morphonal qualificator ultimus*.

Def. 10 $\boldsymbol{mrqmi} = \{(x, y) : x \in \boldsymbol{Dct} \wedge y \in \boldsymbol{mr}^{<} x \wedge \neg \bigvee_{z}(z \in \boldsymbol{mr}^{<} x \wedge z \ \boldsymbol{mrq} \ y)\}$

Def. 11 $\boldsymbol{mrqru} = \{(x, y) : x \in \boldsymbol{Dct} \wedge y \in \boldsymbol{mr}^{<} x \wedge \neg \bigvee_{z}(z \in \boldsymbol{mr}^{<} x \wedge z \ \boldsymbol{mrq} \ z)\}$

"According to definition 10, dicton *x* has morphon *y* as qualificatum initiale or, equivalently, *y* is qualificatum initiale of *x*, in symbols: *x* ***mrqmi*** *y*, iff there is no such morphon *z* in *x*, which would be qualified by *y*. And according to definition 11, dicton *x* has morphon *y* as qualificator ultimus or, equivalently, *y* is a qualificator ultimus of *x*, in symbols: *x* ***mrqru*** *y*, iff there is no such morphon *z* in *x*, by which *y* would be qualified" (Bańczerowski 1997a: 24–25).

In the compound *bawidamek*, the qualificatum initiale is *bawi-* and the qualificator ultimus is *ek*.

In the relation with the qualificatum intiale, there is a proper morphaton which is introduced as follows:

Def. 12 $\boldsymbol{mfp} = \{(x, y) : y \in \boldsymbol{Mot} \wedge \ x \in \boldsymbol{mf}^{<} y \wedge (x = \boldsymbol{mrqmi'} y \vee \vee \ \boldsymbol{mrqmi'} x = \boldsymbol{mrqmi'} y)\}$

In the light of the definition, *x* is a proper morphaton of the morphotacton *y*, in symbols: *x* ***mfp*** *y*, iff *x* is the qualificatum initiale of *y* or they both have a common qualificatum initiale (cf. Bańczerowski 1997a: 25).

In the compound *bawidamek*, the proper morphatons are *bawi-* and *bawidam-*.

All case dictons which are homosemic form a class called a *case* ***CAS***.

Def. 13 ***CAS = Cas/hsm***

The family of cases ***CAS*** must include among others: {Nominative Nom., Accusative Acc., Instrumental Inst., Dative Dat., Ablative Abl., Genitive Gen., Locative Loc. …}.

All parts-of-speech dictons which are homosemic will analogically form a class called *parts of speech* ***PS***.

Def. 14 ***PS = Ps/hsm***

The family of parts of speech will include {noun SUB, verb V, adjective ADJ, adverb ADV, numeral NUM, etc.}.

So far, the relevant interdictonal units have been discussed. They represented various levels of complexity, and consequently various ways of conveying meaning. The interdictonal units can be distinguished in terms of their level of grammaticalization, alternatively called here semification. This is a particularly important factor for compounds because the dictons in compounds have been united and semified to some extent. Such dicton-derived constituents of compounds are called dictoidons. In terms of their semification level, one can distinguish proper and improper dictons which are introduced on the basis of *the relation of being a proper dictoidon* and *the relation of being an improper dictoidon*.

Def. 15

$$\boldsymbol{ddp} = \{(x, y) : y \in \boldsymbol{Dct} \wedge (x \in \boldsymbol{mfp}^{<}\boldsymbol{mfqm'}\, y \vee x \in \boldsymbol{mfp}^{<}\boldsymbol{mfqm'}\, y) \wedge \bigvee_{z \in \boldsymbol{Dct}} (z \neq y \wedge z\ \boldsymbol{hfn}\ x \wedge z\ \boldsymbol{hlk}\ x)\}$$

Def. 16

$$\boldsymbol{ddi} = \{(x, y) : y \in \boldsymbol{Dct} \wedge (x \in \boldsymbol{mfp}^{<}\boldsymbol{mfqm'}\, y \vee x \in \boldsymbol{mfp}^{<}\boldsymbol{mfqr'}\, y) \wedge \bigvee_{z \in \boldsymbol{Dct}} (z \neq y \wedge \neg z\ \boldsymbol{hfn}\ x \wedge z\ \boldsymbol{hlk}\ x)\}$$

"In light of definition 14, *x* is a proper dictoidon of dicton *y*, in symbols: *x* ***ddp*** *y*, iff *x* is a proper morphaton of the maximal qualificatum or of maximal qualificator of *y*, and there is dicton *z*, different from *y*, and such that it is homophonous and homolexical with *x*. And, in light of definition 15, *x* is an improper dictoidon of dicton *y*, in symbols: *x* ***ddi*** *y*, iff *x* is a proper morphaton of the maximal qualificatum or of maximal qualificator of *y*, and there is dicton *z*, different from *y*, and such that it is not homophonous with *x* but it is homolexical with *x*" (Bańczerowski 1997a: 29).

In the compound οἰνό–μελι 'honey mixed with wine, mead' the proper dictoidon is -μελι because it has a homophonic and homolexical equivalent of the dicton μέλι. In the compound μητρο–μήτωρ 'mother's mother', the improper dictoidon is -μετωρ, having a homolexical but not homophonic equivalent μήτηρ.

In general, the relation of being a dictoidon can be formulated as follows:

Def. 17 ***dd*** = ***ddp*** ∪ ***ddi***,

the set of all dictoidons:

Def. 18 ***Dtd*** = ***dd*** 〈 ***Dct***.

Analogically, one can introduce two auxiliary definitions of the sets of all proper ***Ddp*** and improper ***Ddi*** dictoidons:

Def. 19 $\boldsymbol{Ddp} = \boldsymbol{ddp} \langle \boldsymbol{Dct}$

Def. 20 $\boldsymbol{Ddi} = \boldsymbol{ddi} \langle \boldsymbol{Dct}$

Hereby a compound is considered a special type of dicton. The basic difference between a simple dicton and a complex dicton is that the latter has to include at least two morphons conveying the meaning in a lexical way. This is a necessary but insufficient condition. A compound may have a compounding index. Traditionally described, a compound built of two lexical morphons is constructed of the following morphons: lexical-semic-lexical-semic, but the compound indexes (morphons) may be -∅- and -∅ (cf. KLEMENSIEWICZÓWNA 1951: 11; KURZOWA 1976: 65–78).

The semical morphon placed after the first lexical morphon is called an interfix. In the main part of the present article the interfix cannot be distinguished because it is impossible to determine how it would convey the meaning. Therefore the interfix is considered as part of the improper dicton (special type of morphon) which is the first compound constituent. In turn, the second compound constituent is a dicton built of two morphons (special type of morphotacton in this case). The semic morph which belongs to the second constituent is an affix (called afixon) which determines the compound semic category.

The term of afixon is introduced by *the relation of being an afixon:*

Def. 21 $\boldsymbol{af} = \{(x, y):\ y \in \boldsymbol{Dct} \cup \boldsymbol{Dtd} \wedge x \in \boldsymbol{mrqru}^{\check{<}} y \wedge \bigwedge_{\sigma}(\sigma \in \boldsymbol{sgf}^{\check{>}} x \rightarrow \sigma \in \boldsymbol{smf}^{\check{>}} x) \wedge$

$$\wedge \neg \bigvee_{\sigma}[z \in \boldsymbol{Dct} \wedge z\ \boldsymbol{hfn}\ x \wedge (\sigma \in \boldsymbol{smf}^{\check{>}} x \rightarrow \sigma \in \boldsymbol{lkf}^{\check{>}} z)]\}$$

In the light of the definition, *x* is an afixon of dicton or dictoidon *y*, in symbols *x* ***af*** *y*, if *x* is a morphonal qualificator ultimus conveying only semificated meanings and there is no dicton *z* which is homophonic to *z* and lexifies the meanings of *x* (cf. BAŃCZEROWSKI 1997a: 34).

In the compound μητροπάτωρ, the afixon is –ωρ.

Three additional relations will be introduced below, i.e. the relation of semical rection, the relation of congruence and the relation of semic opposition.

Def. 22 $\boldsymbol{rcsm} = \{(x, y): x, y \in \boldsymbol{Dct} \wedge x\ \boldsymbol{wdt}\ y \wedge y \in \boldsymbol{CAS}\text{ - }\boldsymbol{Nom}\}$

In the light of the definition two dictons are in the relation of semical rection iff they are bound by the relation of determination and the qualifying dicton is a case dicton excluding Nom.

Def. 23 $\boldsymbol{cgsm} = \{(x, y): x, y \in \boldsymbol{Dct} \wedge x\ \boldsymbol{wdt}\ y \wedge (\boldsymbol{smf}^{>} x \cap \boldsymbol{smf}^{>} y \geq 1)$

In the light of the definition two dictons are bound by the relation of congruence iff the qualifying dicton semifies at least one of the same meanings as the dicton qualificator.

Def. 24 $\boldsymbol{osm} = \{(x, y): x, y \in \boldsymbol{Dct} \wedge (\boldsymbol{smf}^{>} x \neq \boldsymbol{smf}^{>} y)$

In the light of the definition two dictons are bound by the relation of semic opposition iff they do not semify the same meanings.

4. COMPOUNDS AND THEIR TYPES

The relation of compounding, which is a base of the term of compound, is defined as follows:

Def. 25

$$\boldsymbol{cmp} = \{(x, y), z:\ z \in \boldsymbol{Dct} \wedge x, y \in \boldsymbol{dd}^{<} z \wedge x\, \mathbf{T_{imd}}\, y \wedge \mathbf{S'}(x, y) = z \wedge \bigvee_{u}[u \in \boldsymbol{af}^{<} y \rightarrow u \in \boldsymbol{af}^{<} z]\}$$

In the light of the definition, two dictoidons *x* and *y* build a complex dicton *z*, in symbols (*x*,*y*) ***cmp*** *z*, iff *x* directly precedes *y* and *x* and completely exhausts *z* and every afixon *u* which is part of *y* and afixon of *z*.

The set of all compounds can be introduced according to the definition below:

Def. 26 $\boldsymbol{Comp} = \boldsymbol{cmp} \langle \boldsymbol{Dct}$.

The theorems below express some properties of the relation ***cmp*** and compounds:

Th. 1 $y, z\ \boldsymbol{cmp}\ x \wedge y\, \mathbf{T_{imd}}\, z \rightarrow \bigvee_{u}[u\ \boldsymbol{af}^{<}\ x \wedge u\ \boldsymbol{af}\ z \wedge \neg(u\ \boldsymbol{af}\ y)]$

Th. 2 $\boldsymbol{Comp} \subset \boldsymbol{Dct}$

Th. 3 $x \in \boldsymbol{Comp} \rightarrow \mathrm{card}(\boldsymbol{lkf}^{>} x) \geq 2$

Th. 4 $x \in \boldsymbol{Comp} \rightarrow \mathrm{card}(\boldsymbol{smf}^{>} x) = 1$

Th. 5 $x \in \boldsymbol{Comp} \rightarrow \boldsymbol{mfqm}^{>} x, \boldsymbol{mfqr}^{>} x \in \boldsymbol{Dtd}$

According to the first theorem, an element which is the afixon of the whole compound is more closely related to the second than the first constituent (is also an afixon of the second constituent, and not an afixon of the first constituent) – e.g. in the compound *do marszobiegu* ‘for the endurance march’ the afixon *do…-u* is more closely related to the constituent *-bieg-* than the constituent *marszo-*. According to the second theorem, a compound is a type of dicton. The third and fourth theorems determine semantic properties of compounds – a compound has to have at least two lexificators and one semificator (compounds are similar to simplexes with respect to their semic properties). According to the fifth theorem, both the constituent being the maximal qualificatum and the constituent being the maximal qualificator have to be dictons.

4.1. DIMENSION 1: DEGREE OF COHESION: {HIGH, MEDIUM, LOW}: (TYPICAL COMPOUNDS, CONCRETIONS, AGGREGATES)

Thus compounds may have a divergent structure:

a) both constituents are improper dictoidons;

b) the first constituent is an improper dictoidon, the second a proper one;

c) the first constituent is a proper dictoidon and the second an improper one;
d) both constituents are proper dictoidons.

A compound with the structure as in a), b), c) is called a proper compound and a compound with the structure as in d) is called an improper compound. The term of proper compound is introduced by the relation of being a proper compound ***cmpr***:

Def. 27

$$\boldsymbol{cmpr} = \{(x,y)\, z : z \in \boldsymbol{Comp} \wedge x,y \in \boldsymbol{ddi}^{<} z \vee [x \in \boldsymbol{ddi}^{<} z \wedge y \in \boldsymbol{ddp}^{<} z] \vee [x \in \boldsymbol{ddp}^{<} z \wedge y \in \boldsymbol{ddi}^{<} z] \wedge \wedge x\, \mathbf{T}_{\mathbf{imd}}\, y \wedge \mathbf{S}'(x, y) = z\}$$

In the light of the definition, two dictoidons x and y build a complex dicton z, in symbols (x, y) ***cmpr*** z, iff x directly precedes y in time and both x and y completely exhaust z and at least one of them cannot be homophonic to any dicton.

The set of all proper compounds can be introduced as follows:

Def. 28 $\boldsymbol{Compr} = \boldsymbol{cmpr} \langle \boldsymbol{Dct}$

The following conclusions can be drawn:

Th. 6 $\boldsymbol{Compr} \subset \boldsymbol{Dct}$

Th. 7 $x \in \boldsymbol{Compr} \rightarrow \boldsymbol{mfqm}^{>} x, \boldsymbol{mfgr}^{>} x \in \boldsymbol{Dtd}$

The definition below introduces the term of improper compound by the relation of being an improper compound ***cmi***:

Def. 29 $\boldsymbol{cmi} = \{(x,y)\, z : z \in \boldsymbol{Dct} \wedge x,y \in \boldsymbol{ddp}^{<} z \wedge x\, \mathbf{T}_{\mathbf{imd}}\, y \wedge \mathbf{S}'(x, y) = z\}$

In the light of the definition, two dictoidons x and y improperly build a complex dicton z, in symbols (x, y) ***cmi*** z, iff x directly precedes y in time and both x and y completely exhaust z and both of them have homophonic equivalents among dictons, for example *Wielkanoc* 'Easter'.

The set of all improper compounds can be introduced as follows:

Def. 30 $\boldsymbol{Comi} = \boldsymbol{cmi} \langle \boldsymbol{Dct}$

Moreover, the following conclusions can be drawn:

Th. 8 $\boldsymbol{Compr} \cup \boldsymbol{Comi} = \boldsymbol{Comp}$

Th. 9 $x \in \boldsymbol{Comi} \rightarrow \boldsymbol{mfqm}^{>} x, \boldsymbol{mfqr}^{>} x \in \boldsymbol{Ddp}$

According to theorem 8, proper and improper compounds exhaust the whole set of compounds. According to theorem 9, both the maximal qualificatum and the maximal qualificator of an improper compound have to be proper dictoidons.

Proper and improper compounds (aggregates) reflect the level of semicalization of their constituents. The level of semicalization is the highest in case of proper compounds, which have to include at least one improper dictoidon. The improper compounds are on the other hand at an initial level of semicalization.

Aside from dictoidons, which can conjoin to build proper or improper compounds, one should take into account syntagms constructed of two complex dictoidons, whose semantic structure is similar to complex dictons, e.g. *wieczne pióro* 'fountain pen', *Biała Podlaska*. Aggregates are a special type of syntagms which are built of two dictons (bidictonal syntagms) bound by the relation of determination (hypotaxis).

The set of all bidictonal syntagms $\boldsymbol{Stg_{bdc}}$ is introduced as follows:

Def. 31 $\boldsymbol{Stg_{bdc}} = \{(s) : s \in \boldsymbol{Stg} \wedge \bigvee_x \bigvee_y [x, y\, \mathbf{P} s \cap \boldsymbol{Dct} \wedge s = \boldsymbol{S'}(x, y)]\}.$

In the light of the definition, a bidictonal syntagm is a syntagm built of exactly of two dictons (cf. Bańczerowski 1980: 38).

The relation of determination is defined as follows:

Def. 32 $\boldsymbol{dt} = \{(x, y): x, y \in \boldsymbol{Dct} \wedge \mathbf{S'}(x, y) \in \boldsymbol{Stg} \wedge \mathbf{S'}(x, y)\ \boldsymbol{hpn}\ x\}$

In the light of the definition, the dicton x is determined by the dicton y symbolically $x\ \boldsymbol{dt}\ y$, iff they both build a syntagm which is hyponymic to the dicton x (cf. Pogonowski 1981: 16; 1991b: 66). The predecessor of the relation is called ***determinatum*** and the successor ***determinator***.

The theorems below present the properties of the relation of determination, which is antireflexive, asymmetric and transitive:

Th. 10 $\boldsymbol{dt} \subseteq \boldsymbol{Dct} \times \boldsymbol{Dct}$

Th. 11 $x \in \boldsymbol{Dct} \rightarrow \neg(x\ \boldsymbol{dt}\ x)$

Th. 12 $x\ \boldsymbol{dt}\ y \rightarrow \neg(y\ \boldsymbol{dt}\ x)$

Th. 13 $x\ \boldsymbol{dt}\ y \wedge y\ \boldsymbol{dt}\ z \rightarrow x\ \boldsymbol{dt}\ z$

The term of aggregate is introduced by the relation of aggregation ***prt***:

Def. 33 $\boldsymbol{prt} = \{(x, y)\, z : z \in \boldsymbol{Stg} \wedge x, y\ \mathbf{T_{imd}}\ y \wedge \mathbf{S'}(x, y) = z \wedge$
$\wedge \neg \bigvee_{u \in Dct} [x\ \mathbf{T_{imd}}\ u \wedge u\ \mathbf{T_{imd}}\ y]\}$

In the light of the definition, two dictons x and y aggregate in a syntagm z, in symbols $(x, y)\ \boldsymbol{prt}\ z$, iff x directly precedes y and x in time and there is no dicton u which could divide the dictons x and y.

The set of all aggregates can be shown as follows:

Def. 34 $\boldsymbol{Part} = \boldsymbol{prt} \langle\ \boldsymbol{Stg}$

The following conclusions can be drawn here:

Th. 14 $\boldsymbol{Part} \subset \boldsymbol{Stg_{bdc}}$

Th. 15 $\boldsymbol{Part} \cap \boldsymbol{Comp} = \varnothing$

Th. 16 $x, y\ \boldsymbol{prt}\ z \rightarrow x\ \boldsymbol{dt}\ y \vee y\ \boldsymbol{dt}\ x \wedge \neg(x\ \boldsymbol{kpl}\ y)$

Th. 17 $x, y\ \boldsymbol{prt}\ z \wedge x\ \boldsymbol{dt}\ y \rightarrow x\ \boldsymbol{hpn}\ z$

Th. 18 $x \in \boldsymbol{Part} \wedge y, z\ \mathbf{P}\ x \rightarrow y, z \in \boldsymbol{Dct}$

According to theorem 14, aggregates are a special type of bidictonal syntagms. According to theorem 15, no aggregate can simultaneously be a compound. According to theorem 16, the constituents of aggregate are always bound by the relation of determination. In theorem 17, syntactic-semantic properties of aggregates are presented – the determined constituent of aggregate is hyperonymic to the whole aggregate.

4.2. DIMENSION 2: SYNTACTIC STRUCTURE

In terms of syntactic properties, compounds are divided into determinative and copulative. A determinative compound $\boldsymbol{C_{det}}$ is a compound type whose constituents are bound by the relation of ***mfq***, while in a copulative compound $\boldsymbol{C_{kpl}}$ the constituents are bound by the relation ***kpl***. Formally, these definitions can be presented as follows:

Def. 35 $\boldsymbol{C_{det}} = \{(x) : x \in \boldsymbol{Comp} \wedge \bigvee_{y} \bigvee_{z} [\mathbf{S'}(y, z) = x \wedge y\, \mathbf{T_{imd}}\, z \wedge (y\, \boldsymbol{mfq}\, z \vee z\, \boldsymbol{mfq}\, y)]\}$

Def. 36 $\boldsymbol{C_{kpl}} = \{(x) : x \in \boldsymbol{Comp} \wedge \bigvee_{y} \bigvee_{z} [\mathbf{S'}(y, z) = x \wedge y\, \mathbf{T_{imd}}\, z \wedge y\, \boldsymbol{kpl}\, z]\}$

The following theorems show some mutual relations between determinative and coordinative compounds:

Th. 19 $\boldsymbol{C_{det}} \cup \boldsymbol{C_{kpl}} = \boldsymbol{Comp}$

Th. 20 $\boldsymbol{C_{det}} \cap \boldsymbol{C_{kpl}} = \varnothing$.

4.3. DIMENSION 3: SEMANTIC STRUCTURE

Another classification of compounds can be introduced in terms of their semantic character. Namely, compounds can be divided into endocentric (Sanskrit type tatpurusha) and exocentric (Sanskrit type bahuvrīhi) compounds. As the exocentric type seems to be extremely difficult to describe (as is shown in the main part of this article), the endocentric type will be described first, as follows (cf. Debrunner 1917: 54–55; Beeks 1995: 171):

Def. 37

$$\boldsymbol{C_{end}} = \{(a) : a \in \boldsymbol{Comp} \wedge \bigvee_{x,y \in Dtd} [\mathbf{S'}(x, y) = a \wedge \mathrm{x}\, \mathbf{T_{imd}}\, y] \wedge \bigvee_{u,y \in \boldsymbol{Dct}} [(u\, \boldsymbol{hlk}\, \mathrm{x} \wedge$$
$$\wedge\, w\, \boldsymbol{hlk}\, \boldsymbol{y}) \wedge (x\, \boldsymbol{mfq}\, y \rightarrow a\, \boldsymbol{hpn}\, u) \vee (x\, \boldsymbol{mfq}\, y \rightarrow a\, \boldsymbol{hpn}\, w) \vee (x\, \boldsymbol{cpl}\, y \rightarrow x\, \boldsymbol{hpn}\, \mathbf{S'}(u, w))]\}$$

On the strength of the above definition, a compound is endocentric iff the compound is constructed from two dictoidons which have two homolexic dictons and if the dictoidons are in the relation of morphological qualification then the compound is a hyponym of the dicton homolexical with the dictoidon being a determinatum of the whole compound. Whereas, if both dictoidons homolexical to their dictons are in the relation of copulativity, the whole compound is a hyponym of the two dictons forming a paratactic syntagma.

In turn, the set of all exocentric compounds can be defined as the difference of the set of compounds and the set of endocentric compounds:

Def. 38 $\boldsymbol{C_{egz}} = \boldsymbol{Comp} - \boldsymbol{C_{end}}$.

Moreover, the following relations can be determined:

Th. 21 $x \in \boldsymbol{C}_{end} \rightarrow \boldsymbol{C}_{kpl} \vee \boldsymbol{C}_{det}$

Th. 22 $x \in \boldsymbol{C}_{egz} \rightarrow \boldsymbol{C}_{kpl} \vee \boldsymbol{C}_{det}$

Th. 23 $x \in \boldsymbol{C}_{kpl} \rightarrow \boldsymbol{C}_{end} \vee \boldsymbol{C}_{egz}$

Th. 24 $x \in \boldsymbol{C}_{det} \rightarrow \boldsymbol{C}_{end} \vee \boldsymbol{C}_{egz}$

Endocentric compounds can be further divided into progressive and regressive compounds in terms of the linear order of their dictoidons being qualificators and dictoidons being qualificata.

4.3.1. A DEFINITION OF PROGRESSIVE ENDOCENTRIC COMPOUND

Def. 39 $$\boldsymbol{C}_{end\ prog} = \{(x) : x \in \boldsymbol{Comp} \wedge \bigvee_{y,\, z \in Dtd} [\mathbf{S'}(y, z) = x \wedge y\ \mathbf{T}_{\mathbf{imd}}\ z] \wedge \bigvee_{u,\, w \in Dct} [(u\ \boldsymbol{hlk}\ y \wedge w\ \boldsymbol{hlk}\ z) \wedge (y\ \boldsymbol{mfq}\ z \rightarrow x\ \boldsymbol{hpn}\ w)]\}$$

On the strength of the definition above a compound is progressive endocentric if the compound is constructed from two dictoidons which have two homolexic dictons and if the dictoidons are in the relation of morphological qualification and the qualificatum dictoidon precedes the qualificator dictoidon for example *puruṣavyāghrah* ‘a man like a tiger’.

4.3.2. A DEFINITION OF REGRESSIVE ENDOCENTRIC COMPOUND

Def. 40

$$\boldsymbol{C}_{end\ regres} = \{(x) : x \in \boldsymbol{Comp} \wedge \bigvee_{y,\, z \in Dtd} [\mathbf{S'}(y, z) = x \wedge y\ \mathbf{T}_{\mathbf{imd}}\ z] \wedge \bigvee_{u,\, w \in Dct} [(u\ \boldsymbol{hlk}\ y \wedge w\ \boldsymbol{hlk}\ z) \wedge (z\ \boldsymbol{mfq}\ y \rightarrow x\ \boldsymbol{hpn}\ u)]\}$$

On the strength of the definition above a compound is regressive endocentric iff the compound is constructed from two dictoidons which have two homolexic dictons and if the dictoidons are in the relation of morphological qualification and the qualificator dictoidon precedes the qualificatum dictoidon, for example *Kursteilnehmer* ‘a course participant’, *Wörterbuch* ‘dictionary’.

Moreover, one should establish the semantic relations between a compound and a syntagm from which the compound has been created as a result of the compounding process described by Handke (1976). The compounding process involves joining the words of the syntagm (with possible change of their form) and establishing a common word stress between the words of the syntagm (Handke 1976: 12). Therefore, the compounding process results in the change of dictons belonging to syntagms into dictoidons of compounds.

4.4. DIMENSION 4: SEMANTIC REPRESENTATION OF THE QUALIFICATOR IN THE PARATHESIS

Based on what parts of speech represent the dictons homolexic to the dictoidon-qualificators of the determinative compounds, one can divide them into nominal, adjectival, numeral and verbal. Moreover, nominal compounds can be further divided into nominative, genitive, dative, accusative, instrumentive, locative and ablative compounds based on what are the semical cases of the dictons homolexic to the dictoidon-qualificators.

4.4.1. NOMINAL COMPOUND

Def. 41 $$\boldsymbol{C}_{\boldsymbol{Nominal}} = \{(x) : x \in \boldsymbol{Comp} \wedge \bigvee_{y,\, z \in Dtd} [\mathbf{S'}(y, z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u, w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z)]\}$$

On the strength of the definition a compound is nominal iff it is constructed from two dictoidons which have homolexic dictons belonging to the set of nouns.
determinative nominal compounds can be further divided into:

4.4.1.1. Nominative compound

Def. 42
$$\boldsymbol{C}_{\boldsymbol{Nom}} = \{(x) : x \in \boldsymbol{C}_{\boldsymbol{det}} \wedge \bigvee_{y,\, z \in Dtd} [\mathbf{S'}(y, z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u,w \in \boldsymbol{Dct} \wedge u, w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{cqsm}\, w \wedge u \in \boldsymbol{NOM})]\}$$

On the strength of the definition a determinative compound is nominative (nominatival) iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic congruency and the dicton qualificator is in the semic case Nominative, for example *virá-jāta* ‘born as a hero’ (Żarski 1991: 51).

4.4.1.2. Genitive compound

Def. 43 $$\boldsymbol{C}_{\boldsymbol{Gen}} = \{(x) : x \in \boldsymbol{C}_{\boldsymbol{det}} \wedge \bigvee_{y,\, z \in Dtd} [\mathbf{S'}(y, z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u, w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{rcsm}\, w \wedge u \in \boldsymbol{GEN})]\}$$

On the strength of the definition a determinative compound is genitive (genitival) iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic rection and the dicton qualificator is in the semic case Genitive, for example *Lebensende* ‘end of life’, *Obsthändler* ‘vendor of vegetables’.

4.4.1.3. Dative compound

Def. 44 $$\boldsymbol{C}_{\boldsymbol{Dat}} = \{(x) : x \in \boldsymbol{C}_{\boldsymbol{det}} \wedge \bigvee_{y,\, z \in Dtd} [\mathbf{S'}(y, z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u, w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{rcsm}\, w \wedge u \in \boldsymbol{DAT})]\}$$

On the strength of the definition a determinative compound is dative (datival) iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic rection and the dicton qualificator is in the semic case Dative, for example *Gebetbuch* ‘prayer book’, *Schreibtisch* ‘desk’.

4.4.1.4. Accusative compounds

Def. 45 $$\boldsymbol{C}_{Acc} = \{(x) : x \in \tilde{\boldsymbol{C}}_{det} \wedge \bigvee_{y,z \in Dtd} [\mathbf{S'}(y,z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u,w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{rcsm}\, w \wedge u \in \boldsymbol{ACC})]\}$$

On the strength of the definition a determinative compound is accusative (accusatival) iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic rection and the dicton qualificator is in the semic case Accusative, for example *Kopfschütteln* 'shaking one's head'.

4.4.1.5. Instrumentive compound

Def. 46 $$\boldsymbol{C}_{Instr} = \{(x) : x \in \tilde{\boldsymbol{C}}_{det} \wedge \bigvee_{y,z \in Dtd} [\mathbf{S'}(y,z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u,w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{rcsm}\, w \wedge u \in \boldsymbol{INSTR})]\}$$

On the strength of the definition a determinative compound is instrumentive (instrumentival) iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic rection and the dicton qualificator is in the semic case Instrumentive, for example *Handklatchen* 'applauding', *Kleiderkasten* 'coffer for clothes'.

4.4.1.6. Locative compound

Def. 47 $$\boldsymbol{C}_{Loc} = \{(x) : x \in \tilde{\boldsymbol{C}}_{det} \wedge \bigvee_{y,z \in Dtd} [\mathbf{S'}(y,z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u,w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{rcsm}\, w \wedge u \in \boldsymbol{LOC})]\}$$

On the strength of the definition a determinative compound is locative (locatival) iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic rection and the dicton qualificator is in the semic case Locative, for example *Küchenlampe* 'kitchen lamp', *Seitenaltar* 'lateral alter'.

4.4.1.7. Ablative compound

Def. 48 $$\boldsymbol{C}_{Abl} = \{(x) : x \in \tilde{\boldsymbol{C}}_{det} \wedge \bigvee_{y,z \in Dtd} [\mathbf{S'}(y,z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u,w \in \boldsymbol{SUB} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{rcsm}\, w \wedge u \in \boldsymbol{ABL})]\}$$

On the strength of the definition a determinative compound is ablative (ablatival) iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic rection and the dicton qualificator is in the semic case Ablative, for example *vṛkabhayam* 'fear of wolfs', (cf. Żarski 1991: 51), *svarga-patita* 'coming from the heaven'.

4.4.2. ADJECTIVAL COMPOUND

Def. 49
$$\boldsymbol{C}_{Adj} = \{(x) : x \in \boldsymbol{C}_{det} \wedge \bigvee_{y,z \in Dtd} [\mathbf{S'}(y,z) = x \wedge y\, \mathbf{T}_{\mathbf{imd}}\, z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u\, \boldsymbol{wdt}\, w \wedge u \in \boldsymbol{ADJ}) \vee$$
$$(u,w \in \boldsymbol{Dct} \wedge u\, \boldsymbol{hlk}\, y \wedge w\, \boldsymbol{hlk}\, z \wedge u,w \in \boldsymbol{ADJ} \wedge u\, \boldsymbol{wpt}\, w]\}$$

On the strength of the definition a compound is adjectival iff it is constructed from two dictoidons which have homolexic dictons in the relation of semic congruency and the dicton qualificator is an adjective or both dictons are in the relation of semic parataxis and at least one of the dictons is an adjective, for example *Weisswein* 'white wine', *białogłowa* 'woman, girl'.

4.4.3. NUMERAL COMPOUND

Def. 50 $$\boldsymbol{C}_{\boldsymbol{Num}} = \{(x) : x \in \boldsymbol{C}_{\boldsymbol{det}} \wedge \bigvee_{y,z \in Dtd} [\mathbf{S'}(y,z) = x \wedge y\,\mathbf{T}_{\mathbf{imd}}\,z] \wedge \bigvee_{u,w \in \boldsymbol{Dct}} [(u\,\boldsymbol{hlk}\,y \wedge w\,\boldsymbol{hlk}\,z \wedge \wedge u\,\boldsymbol{wdt}\,w \wedge u \in \boldsymbol{NUM})]\}$$

On the strength of the definition a compound is numeral iff it is constructed from two dictoidons which have homolexic dictons in the relation of determination and the dicton qualificator is a numeral, for example *fünfeinhalb* 'five and a half', *dwudziestoletni* '20-year-old' *saptar̥ṣayaḥ* 'seven seers'.

4.4.4. VERBAL COMPOUND

Def. 51

$$\boldsymbol{C}_{\boldsymbol{Verb}} = \{(x) : x \in \boldsymbol{C}_{\boldsymbol{det}} \wedge \bigvee_{y,z \in Dtd} [\mathbf{S'}(y,z) = x \wedge y\,\mathbf{T}_{\mathbf{imd}}\,z] \wedge \bigvee_{u,w \in \mathbf{Dct}} [(u\,\boldsymbol{hlk}\,y \wedge w\,\boldsymbol{hlk}\,z \wedge u\,\boldsymbol{wdt}\,w \wedge u \in \boldsymbol{VERB})]\}$$

On the strength of the definition a compound is verbal iff it is constructed from two dictoidons which have homolexic dictons in the relation of determination and the dicton qualificator is a verb, for example *weitermachen* 'keep doing', *gehen lassen* 'let go'.

4.5. DIMENSION 5: MORPHOLOGICAL STRUCTURE

To describe the morphological structure of compounds one should consider the number of compound parts susceptible to inflexion. In terms of the susceptibility to morpho-semical flexion of their dictoidons, compounds are constructed of:

4.5.1. ALL DICTOIDONS IN THE ALGID FORM WHICH ARE NOT SUSCEPTIBLE TO MORPHO-SEMICAL FLEXION

Def. 52 $$\boldsymbol{C}_{\boldsymbol{nf}} = \{(x) : x \in \boldsymbol{Cmp} \wedge \bigvee_{y,z \in \boldsymbol{Dtd}} [\mathbf{S'}(y, z) = x)] \wedge \bigvee_{v} \bigvee_{w} (v\,\boldsymbol{hfn}\,y \wedge w\,\boldsymbol{hfn}\,z \wedge \wedge (\boldsymbol{Wosm}^{>} v = \varnothing \wedge \boldsymbol{Wosm}^{>} w = \varnothing)\}$$

The dictons homophonic to the dictoidons of the compound have no equivalents in the relation of semical opposition, e.g. *superkarate*.

4.5.2. DICTOIDONS SUSCEPTIBLE TO MORPHO-SEMICAL FLEXION AND DICTOIDONS NOT SUSCEPTIBLE TO MORPHO-SEMICAL FLEXION

Def. 53

$$\boldsymbol{C}_{\boldsymbol{hf}} = \{(x) : x \in \boldsymbol{Cmp} \wedge \bigvee_{y,z \in \boldsymbol{Dtd}} [\mathbf{S'}(y, z) = x)] \wedge \bigvee_{v} \bigvee_{w} (v\,\boldsymbol{hfn}\,y \wedge w\,\boldsymbol{hfn}\,z \wedge \boldsymbol{Wosm}^{>} v = \varnothing \wedge \wedge \boldsymbol{Wosm}^{>} w = \varnothing)\}$$

There are dictons homophonic to the dictoidons of the compound. Only one of the dictons has an equivalent in the relation of semic opposition, e.g. *wiercipięta* 'fidget', *Hochzeit* 'wedding'.

4.5.3. ALL DICTOIDONS SUSCEPTIBLE TO MORPHO-SEMICAL FLEXION

Def. 54

$$\boldsymbol{C_{hf}} = \{(x) : x \in \boldsymbol{Cmp} \wedge \bigvee_{y,z \in \boldsymbol{Dtd}} [\mathbf{S'}(y, z) = x] \wedge \bigvee_{v} \bigvee_{w} (v\ \boldsymbol{hfn}\ y \wedge w\ \boldsymbol{hfn}\ z \wedge \boldsymbol{Wosm}^{>} v \neq \varnothing \wedge \wedge \boldsymbol{Wosm}^{>} w \neq \varnothing)\}$$

The dictons homophonic to the dictoidons of the compound have equivalents in the relation of semical opposition, e.g. *Wielkanoc* 'Easter', *rzeczposopolita* 'republic'. Based on the above, compounds can be constructed either of dictoidons in the algid form and at least one dictoidon susceptible to morpho-semical flexion, e.g. *Hochmut* 'arrogance' *wiercipięta* 'fidget', or only of dictoidons susceptible to morpho-semical flexion, for example *Wielkanoc, rzeczpospolita*.

4.6. LINEAR ORDER

In terms of the position in linear order of the dictoidons in the compounds, dictoidons can be divided into:

4.6.1. DICTOIDONS IN FINAL POSITION

There is a dictoidon belonging to an actual compound. There is no other dictoidon of the compound that would follow it.

Def. 55 $$\boldsymbol{Dt} = \{(y) : x \in \boldsymbol{Dtd} \wedge \bigvee_{x \in \boldsymbol{Cmp}} \bigvee_{z \in \boldsymbol{Dtd}} [\mathbf{S'}(y, z) = x \wedge \neg\, y\ \mathbf{T_{imd}}\ z)\}$$

4.6.2. DICTOIDONS IN CENTRAL POSITION

There is a dictoidon belonging to an actual compound. There is another dictoidon of the compound that precedes it and there is also another dictoidon of the compound that follows it.

Def. 56 $$\boldsymbol{Dc} = \{(b) : b \in \boldsymbol{Dtd} \wedge \bigvee_{x \in \boldsymbol{Cmp}} \bigvee_{a,c \in \boldsymbol{Dtd}} [\mathbf{S'}(a, b, c) = x \wedge a\ \mathbf{T_{imd}}\ b \wedge b\ \mathbf{T_{imd}}\ c)\}$$

4.6.3. DICTOIDONS IN INITIAL POSITION

There is a dictoidon belonging to an actual compound. There is no other dictoidon of the compound that precedes it.

Def. 57 $$\boldsymbol{Din} = \{(y) : y \in \boldsymbol{Dtd} \wedge \bigvee_{x \in \boldsymbol{Cmp}} \bigvee_{z \in \boldsymbol{Dtd}} [\mathbf{S'}(y, z) = x \wedge \neg\, z\ \mathbf{T_{imd}}\ y)\}$$

As regards relations between the susceptibility of dictoidons to morpho-semical flexion and their position in the linear order of the dictoidons in compounds, the dictoidons in algid form may take only initial and central position but cannot take final position. The dictoidons susceptible to the morpho-semical flexion may take the initial, central and final position in the linear order of the dictoidons in compounds.

5. CONCLUDING REMARKS

The general theory of compounding appears to be sufficiently developed to be axiomatically reconstructed. Moreover, the terminology proposed in the theoretical framework seems to be useful for the purpose of the elaboration of axiomatic formulas applied to all ethnic languages.

The authors are convinced that the axiomatic reconstruction of morphological and syntactic properties of compounds developed in the present paper sheds new light on the position of compounds in the language system, and will consequently contribute to the development of general-linguistic research on morphology.

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