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RELATIONSHIPS OF WORD-FORMATION AND LOGICAL SEMIOTICS

Object of word-formation research

Logic developed a theory of names to which Polish logicians of the Lvov-Warsaw School eminently contributed. However, logicians do not delve into the structure of names of certain type, and treat them as inseparable lexical units. Yet in natural (e.g. Indo-European) languages there are words whose structure is decomposable into at least two elements. Such names are, among others, the subject of research of the linguistic area called word-formation.

Polish linguistic terminology uses the term "word-formation," or its synonym "derivation," in two senses. In one sense, "word-formation" is a name of certain morphological processes that take place in ethnic language. These processes consist in creating new words from words already existing in the lexical repository. Products of these processes are called derivatives or word-formations; while the words from which derivatives originate are called base words, or word-formation bases.

The other sense of the term "word-formation" refers to the linguistic discipline that studies word-formation processes, their results (that is, derivatives), formal units (morphemes) by means of which derivatives are constructed, and derivation rules. Word-formations belong to different classes of parts of speech. Depending on the category membership of the derivatives (*nomina — verba*), they have in sentences of the Polish language, similarly to *simplicia* (that is, inseparable words), syntactic functions of defining and defined elements. Because of the two-fold structure of derivatives, they are included into the syntagmatic type of linguistic signs, that is, such units of

language whose structures are composed of elements with certain semantic functions. Derivatives, because of their morphological separability, are opposed to amorphous, that is further indecomposable, words.

In word-formation research, as in other areas of linguistics, there are two approaches: diachronic and synchronic. What is characteristic of the former is the historism of word-formation phenomena, studying their evolution through the ages. On the other hand, word-formation from a synchronic perspective consists in describing the existing word-formation system of a particular language in a particular time, e.g. in the present or one of the previous epochs.

The aim of diachronic word-formation is to establish genetic relationships between base words and their derivatives, and discover development tendencies in word-formation processes. Researchers in synchronic word-formation omit this genetic aspect as they focus on establishing formal and semantic relationships between words co-existing in the lexical repository of the studied linguistic system. Some descriptions of the word-formation system of a particular ethnic language combine both of these aspects.

The primary relation on which synchronic (also called functional) word-formation focuses is foundation; this relation occurs between two forms of linguistic signs, or their two functions, of which one (form or function) implies the other. The conditioning form (or function) is called "founding," while the conditioned — "founded." In the case of the word-formation relation, the founded word is a derivative, while the founding one is the word that motivates the functioning of the derivative in the word-formation system. Besides the relation of foundation, the synchronic description of word-formation facts also covers motivational relations between co-existing related words (or forms). The relation of foundation links two words (e.g. *malować* "to paint" : *malarz* "painter"), while the relation of motivation links a series of words (forms) with a common morpheme, e.g. a root[1] or an affix. The following exemplify mutually motivating words or word forms: 1) *malować* "to paint," *malowanie* "painting," *malarz* "painter," *malarstwo* "paintings," *malowidło* "painting, mural," *malowanka* "coloring book," etc., or 2) *malarnia* "paint shop," *drukarnia* "printing-house," *farbiarnia* "dye-house," *kwiaciarnia* "florist's," etc. What the former series of words has in common is a common root, the latter — a common suffix.

It is not possible here to enumerate all variously understood tasks or the

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[1]*Root* in linguistics is a word element that is formally and semantically inseparable; while *affix* is a word-formation morpheme which, together with a root, creates a complex, that is, separable linguistic element, e.g. a stem or a compound word.

whole of rich and often controversial issues of word-formation. However, it seems that the aim of word-formation analyses is, among others, to work out a general classifying schema within which it is possible to place a diverse set of empirically asserted facts. Despite the principal differences between the signalized approaches (diachronic and synchronic), certain issues are common to both areas of word-formation research. The main problem emerging in word-formation analysis is the relation of the form of a derivative to its meaning. It is associated with more detailed issues, such as: 1) the relation between a base word and its derivative; 2) category properties of a word-formation base; 3) the relation between the derivative's elements and their formal-semantic, and other, functions.

As a result of the thesis on the syntagmatic nature of word-formation structure, the derivative can be understood as a kind of syntactic structure, which has certain properties analogous to the properties of syntactic structures, e.g.: 1) the two-foldness of word-formation and syntactic structures; 2) the relation of subordination of certain elements (so called marginal) to others (so called central); 3) the presence of autosemantic[2] and synsemantic,[3] etc. elements. The enumerated properties of word formations imply their syntactic interpretation.

Word-formation, from a syntactic perspective, is understood as a kind of inter-morpheme syntax, which is analogous to inter-word syntax; inter-morpheme syntax is based on the assumption that the stem[4] of a suffixal derivative has a defining function, while the formant[5] indicates what is defined, in other words, what is the subject of defining. Thus elements of a formation have parallel functions to those of elements of syntactic constructions.

In accordance with W. Doroszewski's view (Doroszewski 1946), word-formation is an equivalent of an affirmative sentence, while its elements

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[2]Autosemantic elements are independent linguistic units which have certain meaning even if they are used separately, that is beyond syntagmatic relations.

[3]Synsemantic words are auxiliary linguistic elements which do not have autonomous semantic functions, e.g. prepositions, conjunctions, etc.

[4]*Stem* is the word part that remains after separating the formant (e.g. an affix). The stem, similarly to the root, is an indicator of the lexical meaning of a particular word. What can be the stem is either a root (cf. *dom-* "house" : *domisko* "(large) house," or a root expanded by means of an affix (cf. *druk-* "print" : *druk-ar+nia* "printing-house," *-rzut-* "throw" : *od-rzut-owi+ec* "jet plane").

[5]*Word-formation formant* is a morpheme which creates certain specific semantic and syntactic categories (e.g. *nomina*, *verba*). According to linguists, the formant does not have a precise semantic function as e.g. the stem (c.f. note 4 above).

correspond to sentence elements (e.g. which are in the relation: subject — predicate, or subject phrase — predicate phrase). Treating the structure of a derivate as a parallel to the structure of a sentence raises certain objections, both logical and grammatical in nature.

Word-formations differ from sentences with the following logical and grammatical properties: 1) the name of a two-fold structure and the sentence do not belong to the same semantic category, and do not have the same syntactic function; 2) names refer to things in a broad sense, while affirmative sentences describe states of affairs, situations; 3) from the logical standpoint, affirmative sentences can be characterized by assertion, while names — cannot; 4) the meaning of affirmative sentences with assertion is a logical proposition, whereas names do not express logical propositions. Names are elements of sentences and can be contrasted with them.

Differentiating between the name and the sentence structures is based in grammar on the opposition of predication and determination, and the opposition of the sentence-creating function (Kuryłowicz 1960b) of the defining element (the predicate as *verbum finitum* or the nominal predicate, that is, a copular verb followed by the predicative complement) and the constitutive function of the element defined in the syntactic phrase. In other words, the central element of the sentence is its defining element (e.g. *człowiek **drukuje***[6] "person prints," *człowiek jest **śmiały*** "person is daring"); while the central element of the multi-word name is the defined element (e.g. *śmiały **człowiek*** "daring person," *drukujący **człowiek*** "printing person," etc.).

In word formation the hierarchical relation between elements of the formation is not as clear as in the sentence or the syntactic phrase. For the formant and the stem are not units of independent meaning, that is, linguistic signs (cf. *druk-* and *-arz* [*drukarz* "printer"] or *śmiał-* and *-ek* [*śmiałek* "daredevil"]). I am inclined to treat both morphemes of the formation (that is, the stem and the formant) as synsemantic elements which function as a kind of substitute for linguistic signs.

Word-formation researchers put forward the hypothesis that the formant is functionally subordinate to the stem.[7] It seems that the principle of

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[6]The constitutive elements of the sentence and the syntactic phrase are marked here in bold.

[7]It is an implication of J. Kuryłowicz's view, cf.: "Le sémantème ou la racine du mot représente sa partie constitutive, les éléments accessoires ce sont les différents morphèmes synsémantiques ou les affixes (suffixes, préfixes, infixes)" (Kuryłowicz 1960a: 26).

subordination needs to be relativized to the opposition: the weight of the semantic function of the stem — the weight of the formal function of the formant. The formal function of the formant consists in that the formant determines the category of the formation, and assigns the formation to a certain class of parts of speech. Whereas the stem characterizes the class of objects to which the formation refers, and thus makes the meaning of the whole word precise.

If we assume that the stem is the central element of the derivative, and that the stem in the structure of a two-fold name functions as the defining element, then the stem's function would be analogous to the function of the defining element in the sentence, which would imply a parallelism between the word-formation and the sentence structures. However, I enumerated arguments against treating these two categories of linguistic signs as parallel.

From the alternative: the sentence or the syntactic phrase, I eliminated the former. Thus, it would seem that the word-formation structure is parallel to the structure of the syntactic phrase. However, the fact that this word-formation differs from the syntactic phrase, not only in linking morphemes[8] but also in that the functions of the formant and the stem change depending on the semantic type of the formation, cannot be neglected. For example, in semantically neutral[9] suffixal formations, the formant usually predicts something that is defined (e.g. sets of things, events), thus it has a semantic function parallel to the function of the defined element in the syntactic phrase, while the stem — to the function of the defining element, cf.:

$$\text{druk} + \text{arz} \qquad \text{śmiał} + \text{ek}^{10}$$
$$\text{drukarz "printer"} \qquad \text{śmiałek "daredevil"}$$
$$\updownarrow \quad \updownarrow \qquad \qquad \updownarrow \quad \updownarrow$$
$$<<\text{drukujący człowiek}>> \qquad <<\text{śmiały człowieky}>>$$
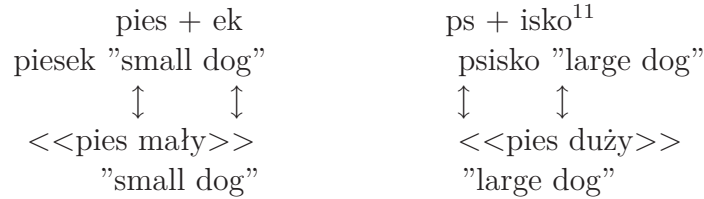$$\text{"printing person"} \qquad \text{"daring person"}$$

In derivatives of expressive meaning, the formant as an indicator of a property (or a collection of properties) functions analogously to the function of the defining element, while the stem — of the defined element, cf.:

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[8]In my opinion, linking the formant with the stem in word-formation needs to be of a different nature than the relation of the defined and the defining element in the syntactic phrase, because word-formation elements are not independent linguistic signs, while elements of the syntactic phrase have autonomous semantic functions.

[9]I oppose semantically neutral formations to formations with expressive tones.

[10]The formants *-arz*, *-ek* in the given examples correspond to the defined element in the syntactic phrase, e.g. *człowiek* "person."

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\begin{array}{cc}
\text{pies} + \text{ek} & \text{ps} + \text{isko}^{11} \\
\text{piesek "small dog"} & \text{psisko "large dog"} \\
\updownarrow \quad \updownarrow & \updownarrow \quad \updownarrow \\
<<\text{pies mały}>> & <<\text{pies duży}>> \\
\text{"small dog"} & \text{"large dog"}
\end{array}
$$

Such a situation does not take place in the syntactic phrase, e.g. *śmiały* **człowiek** "daring person," *mały* **pies** "small dog," *duży* **pies** "large dog,"[12] etc.

Thus, deciding which element of the complex word is central, and which is marginal, and defining the semantic role of each element seem to depend on the semantic or the formal approach in the word-formation analysis. In the formal approach, what can be considered the central element is the formant, because it determines the type of structure, while in the semantic approach — the stem as an indicator of the characteristic (dominating) property of a referent. Because both elements of the formation have formal functions and also partially certain semantic functions, it is difficult to categorically decide which of the functions is superior.

The word-formation stem is treated by word-formation researchers as the main carrier of the lexical meaning of the formation, however the semantic function of the formant is not defined sufficiently clearly. Admittedly, word-formation deals with the conceptual role of the formant as an indicator of a certain class of notions of the extra-linguistic area. Because of this, researchers assign to the formant a certain semantic value that consists in "abstractifying" the lexical meaning of the whole formation. Such an approach to the function of the formant does not sufficiently explain the formant's role, because it introduces at least two levels of abstractiveness. For there is yet another *abstractum* in the lexical meaning of the whole formation, that is, the "abstractified meaning" of the formation (see Brodowska-Honowska 1967: 13). Thus, the questions if the formant contributes some part of its lexical meaning to the word-formation structure, and what is the type of this meaning, remain open.

Solving the problems presented here as examples is crucial as a syntactic analysis of derivatives involves certain interpretative operations, which are

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[11]The formants -ek, -isko in complex words of expressive meaning correspond to the defining element in the syntactic phrase, while the stem corresponds to the defined element in the phrase. These correspondences are marked here with the up down arrow.

[12]The defined element, i.e. central in the syntactic phrase, is marked here in bold.

by some linguists called transformation. Other researchers, who explain the meaning and the structure of word-formations by means of expressions which are more formally developed, think that such a research approach is not a conversion of the word-formation structure into the syntactic structure.

Transformation rules of Polish word-formation are not yet developed. Polish derivatives cannot be transformed analogously to derivatives in languages whose word-formation system has a greater share of word formation composition (as in e.g. German). In Polish, derivatives are usually results of affixation. Still, a conversion of affixal structures into appropriate syntactic constructions is possible in Polish word-formation. However, it is not a transformation in the strict meaning of the word, but a quasi-transformation. Its bases cannot be formulated only by means of linguistic methods. The bases of quasi-transformation interpretation of word-formation facts of the Polish language need to be based on some methods of the linguistic expression analysis which are used in logical semiotics.

Semiotic approach to word-formation analysis

The semiotic approach to analyzing a two-fold name (that consists of the stem and the formant) deals not only with the name's relation to an object of the external reality, but also with the usage of a particular name in utterances of a particular language.

From the point of view of contemporary logic, sentences in the logical sense are fundamental semantic units. From the point of view of linguistics, the hierarchy of linguistic structures is established on account of the level of independence of these structures. The highest level of independence belongs to the sentence. It is a central element in syntax, similarly to a word form in morphology. Thus, using the syntactic interpretation in studying word-formation phenomena, I take the sentence to be the starting point of my considerations. The meaning of a derivative can be reconstructed on the basis of the sense of the sentences in which a particular formation is embedded, or by means of definition.

The first approach occurs when a particular formation that functions directly in linguistic texts is analyzed. The other approach can be applied when morphologically separable names are treated as isolated dictionary items, that is, as headwords defined in dictionaries. Both of these approaches can be realized simultaneously in order to verify the correctness of results of one or the other method.

Both the usages of names in utterances, and dictionary definitions indicate that a significant part of derivatives are polysemous and lexicalized[13] words, that is, words that do not have a morphologically transparent structure due to breaking the relationship between a given formation and the founding word. Determining the relation of the meaning of a morphologically separable name to the name's form often causes considerable trouble to the interpreter. For the meaning of a derivative is embedded in the form, which exposes some elements and conceals others. In order to determine the relation, it is necessary to have comparable elements, while the meaning and the form do not meet this condition; they are something else.

The notion of meaning can be compared to a (physical or conceptual) material to whom people give different shapes. For example, a quantity of a resource is a material from which certain (e.g. architectural) constructions are made, the constructions can have various forms. Human thoughts, which refer to the realities (or the notions) of the external world, also constitute a material which creates certain semantic constructions that are realized in various forms. These constructions need to be given a certain shape, that is, to be organized into appropriate schemas. A structure constructed by the interpreter cannot be isomorphic to the word-formation form. However, both of these structures (the proposed semantic one and the one functioning in linguistic reality) need to have a certain common property. It is either the identical meaning (= a set of properties), or the identical scope, that is the set of referents to which both structures refer. In order to differentiate between the two, I use the following working expressions: "semantic structure" and "formal structure." What I called "semantic structure" is precisely such a semantic construction which can be expressed by means of identical formal elements embedded in the derivative, but also elements not expressed through the form of the derivative. The semantic structure is not the same as the structural meaning. For the structural meaning results from linking the stem with the formant, that is, from the formal structure (= form) of the two-fold name. The semantic structure does not result from linking the name's formal elements. Also, it is not the same as the lexical meaning (updated each time) of a word-formation. The lexical meaning of each instance of a two-fold name

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[13]Lexicalized words are the ones that underwent the so called process of lexicalization, which consists in that a morphologically transparent word loses its formal transparency due to breaking a link to the basic word, that is, the one that originated a given word form; this form is perceived by speakers as an inseparable linguistic sign, cf. e.g. *pogorzelisko* "site after fire, conflagration site," *oparzelisko* "boggy and swampy soil," etc.

is given in dictionaries, also in experiences and linguistic practice.

The semantic structure is a schema of the lexical meaning in the broadest sense, it is a representative of a certain class of lexical meanings (e.g. meanings indicating agents of actions, carriers of properties and states, places, sets of properties, etc.), thus it is abstractified from particular lexical meanings of a certain group of derivatives with close (or identical) meanings. In other words — the semantic structure of a series of word-formations is the construction which by nature is independent of subjective, specific and present realizations.

The schema of the semantic structure includes exponents which inform about the relation between an object and its representative property by means of the formant and the stem. Admittedly, the structural meaning informs us about a certain relation between a given object and its representative (i.e. dominating) property, but it does not communicate what type of relation it is. The relation is shown by the semantic structure which is presented in a more elaborate form than the form of analyzed name. The structural meaning of a formation, e.g. *kartoflisko* "potato field" can be presented as follows:

miejsce "place"	(?)	kartofle "potatoes"ŕ
-isko		*kartofl-*

The form of the semantic structure shows the relation of a referent of the word *miejsce* "place" and a referent of the word *kartofle* "potatoes;" for the relation is illustrated by means of the expression: a place where people grow potatoesŕ or a place where potatoes are grownŕ. Thus the schema of the semantic structure expresses *explicite* what is *implicite* included in the structural meaning of a word formation.

A word formation inherited through the language tradition and established by the language custom is conventional. For this form was shaped by many generations of speaking people. The semantic structure is also characterized by convention, but it is a convention determined by the interpreter. If a word formation in a particular sentence context can be replaced by the schema of its semantic structure, then the schema can be regarded as correct. For example, the word *brodacz* "bearded man" is treated interchangeably with the expression man with beardŕ, *nauczyciel* "teacher" teaching personŕ, *drukarnia* "printing-house" printing companyŕ, etc.

The semantic equivalents of the quoted examples are expressions in the form of syntactic phrases.[14] These phrases, similarly to word formations, do

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[14]In a further part of the article I will use the sign "*E*" (= expression) instead of

not include formal exponents which would communicate the relation of a particular object and another object or property. We cannot explain, for example, the meaning of the derivate *pomarańczarnia* "orangery" by means of the syntactic phrase whose defining element is a prepositional expression a room with orangesŕ. This expression does not precisely inform us about the name's meaning. An adequate translation of the formation is: a room in which oranges are grownŕ.

Since the Polish language has various alternatives for constructing expressions that represent the semantic structure of morphologically separable names, it is necessary to choose such a form of the expression that would meet the following criteria: 1) it should be expression *E*, whose form will least relatively obliterate the link between the semantic structure of name *N* and its structural meaning; 2) *E* should be a structure composed of parts parallel to elements of *N*, that is, comparable parts which will be made incomparable, i.e. semantically or formally diversified, parts visible. Hence *E* needs to expose at least some semantic elements of *N*, especially the ones that determine the name's structural meaning. Due to the mentioned reasons, it is postulated that the form of *E* is normalized. The postulate can be realized at least for some word-formation types of *N* which belong to the class of appellatives, that is, words corresponding to general names in a logical classification of names.

Thus, the basis for a quasi-transformation in word-formation is "structuralization" of lexical meanings of *N*, and more precisely — groups of semantically homogeneous derivatives. This operation enables us to present in schemas something as immeasurable and shapeless as meaning. Schemas *E* make the notion more concrete. It is a technical procedure which is verifiable by means of replacing *N*s in particular utterances of the Polish language by semantically corresponding *E*s. The semantic correspondence of *N* and its potential substitute *E* is an equivalence relation in nature.

In accordance with views of linguists, a transformation of a certain type of language structure into a different type of language structure is based on the principle of equivalence, that is, semantic equivalence. The notion "semantic equivalence" needs to be elaborated on, because this relation can be understood in a different way.

There is no relation of semantic identity between *N* and *E*. *N* and *E* are

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the expression "syntactic phrase," while instead of the expressions "morphologically separable name," "a word formation," "derivative" I will use the symbol "*N*." The syntactic phrase "*E*" is a form given by the interpreter to the semantic structure of a particular "*N*."

non-isomorphic as a result of *E* containing more language elements than *N*. These are, among others, elements so to speak "added" by the interpreter, and thus — redundant in relation to elements of *N*.

I assume that the relation of equivalence between *N* and *E* is a relation of their scopes (= denotations), that is, such that *N* denotes a set of references identical to the set of objects denoted by *E*. Equivalence as a symmetrical relation entitles interchangeability of elements of the equivalence relation. For example, compare the sentence: [...] *as far as the eye could see, there was a wide plain* ⇔ [...] *as far as the eye could see, there was a wide area whose surface was flat.*

I described the relation of denotative equivalence between *N* and *E* in a monograph[15] in which I formulated a nominal scope definition in a semantic fashion. The *definiens* of the definition is in the form of logical indefinite description, that is, a name expression which, by means of a description, refers to the same extra-linguistic objects as name *N* occurring in the *definiendum*.

Due to the mentioned reasons, we can regard *N* as an abbreviation of descriptions, in other words — a contracted description. Since *N* and *E* belong to the same syntactic category of names and have analogous semantic and syntactic functions in sentences of the Polish language, they can be treated as isosemantemic and isofunctional entities.

Grammatical analysis of internal relations in expressions *E*

In order to realize the postulate of normalization of the forms of *E*, which are to represent the semantic structure of a few word-formation types of *N*, we construct expressions

type 1 a) człowiek, który **maluje**[16] :**malarz**[17]

b) człowiek, który wytwarza **modele** [18] :**modelarz**[19]

c) przedmiot, który **budzi**[20] :**budzik**[21]

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[15]I discussed this issue in more detail in: Judycka 1971.

[16]["person who **paints**"] Words in bold are in a derivational relation; for example, in expressions "E," the word marked in a different font is a word-formation base for a particular "N."

[17]["**painter**"]

[18]["person who makes **models**"]

[19]["**modeller**"]

[20]["object that **wakes up**"]

[21]["**alarm clock**"]

type 2 a) człowiek, który jest **śmiały**
or **śmiały** człowiek [22] :**śmiałek**[23]

b) **głęboka** woda[24] :**głębina**[25]

type 3 a) miejsce[26], na którym rosną **wrzosy**[27] :**wrzosowisko**[28]

b) miejsce, na którym gnieżdżą się **węże**[29] :**wężowisko**[30]

c) miejsce, na którym uprawiają **kartofle**[31]
or miejsce, na którym wykopali **kartofle**[32] :**kartoflisko**[33]

d) miejsce, na którym uprawiają **truskawki**[34] :**truskawkarnia**[35]

e) miejsce, w którym uprawiają **pomarańcze**[36] :**pomarańczarnia**[37]

f) miejsce, w którym sprzedają **kwiaty**[38] :**kwiaciarnia**[39]

g) miejsce, w którym wytwarzają **cegłę**[40] :**cegielnia**[41]

h) miejsce, w którym **przechowują**[42] :**przechowalnia**[43]

i) miejsce, w którym przechowują **bagaże**[44] :**bagażownia**[45]

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[22]["**daring** person"]
[23]["**daredevil**"]
[24]["**deep** water"]
[25]["**water depths**"]
[26]The use of the word *miejsce* "place" in E signalizes that I treat the scope of the name *miejsce* "place" as a sum of scopes of other names, namely those which refer to various concrete parts of physical space.
[27]["place where **heather** grows"]
[28]["**moor**"]
[29]["place where **snakes** rest"]
[30]["**snake nest**"]
[31]["place where **potatoes** are grown"]
[32]["place where **potatoes** have been digged"]
[33]["**potato field**"]
[34]["place where **strawberries** are grown"]
[35]["**strawberry field**"]
[36]["place where **oranges** are grown"]
[37]["**orangery**"]
[38]["place where **flowers** are sold"]
[39]["**florist's**"]
[40]["place where **bricks** are made"]
[41]["**brickyard**"]
[42]["place where things are **stored**"]
[43]["**storehouse**"]
[44]["place where **luggage** is stored"]
[45]["**left luggage office**"]

type 4 fakt, że się **naucza**[46]
    or że się **naucza**[47]   :**nauczanie**[48]

type 5 fakt, że się **naucza**[49]
    or że jest **sprawiedliwie**[50]   :**sprawiedliwość**[51]

From the linguistic point of view, *E* (1—5) are syntactic phrases with a characteristic structure.

The function of the defined element is fulfilled by a noun, or sometimes by the indefinite pronoun *somebody, something* replacing it. The defining element has the form of a subordinate clause,[52] that is, a clause that does not express a full proposition, but only a certain part of it. This part of a proposition is expressed by means of an attributive of the defined element, which creates, together with the defined element, an attributive syntactic phrase.

Subordinate clauses in the defining element are of different grammatical character depending on the introductory word. For example, the defining elements in expressions of the type 1, 2 are attributive relative clauses introduced by the pronouns *który* "which" or *kto* "who," *co* "that." The defining elements in syntactic phrases *E* of the type 3 are adverbial clauses of place introduced by the expressions *w którym* "in which, where," *po którym* "after which, where," *na którym* "on which, where."[53]

The semantic role of pronouns in word phrases *E* consists in that they refer to the defined noun but also, at least partially, acquire its meaning; thus, pronouns have a denotation analogous to the denotation of the name they replace in the defined element. A pronoun, e.g. *który(e)* (cf. types 1, 2) so to speak reflects the denotation of the noun it substitutes. The prepositional expressions *w którym* "in which, where," etc. (cf. type 3) have in principle an identical logical function, though differ from the pronoun *który(e)* in that they in some way locate things whose names are word-formation bases for

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[46]["fact that one **teaches**"]

[47]["that something is **taught**"]

[48]["**teaching**"]

[49]["fact of being **just**"]

[50]["that it is **just**"]

[51]["**justice**"]

[52]Some linguists treat subordinate clauses as syntactic phrases. In my opinion, clauses of this kind can be regarded as special type of sentences.

[53]The expressions *po którym* "after which, where," *na którym* "on which, where," *w którym* "in which, where," etc. functionally correspond to the relative pronoun *where*.

nomen loci. For the prepositions accompanying pronouns inform, if the given objects are inside or on the surface of a given part of physical space.

From the point of view of linguistic syntax, the pronoun *który(e)* introducing an attributive relative clause functions as the grammatical subject of this clause; it refers back to its antecedent with which it agrees in gender, number and case. In this way the pronoun *który(e)* links the defined element with the subordinate clause in the defining element. *Mutatis mutandis* the above remark applies also to the expressions *w którym,* etc., though they function as adverbials of place in the adverbial clause in the defining element of *E*. The expressions *w którym, na którym* etc. are equivalent to the expression *w nim* "in it," which can be illustrated by a slightly deformed structure of the following:

takie miejsce, że w nim coś **przechowują** "such a place that things are stored in it" : **przechowalnia** "storehouse."

The following relations occur between components in the defining elements of syntactic phrases *E*:

type 1 — the relation of the verbal predicate in the form of a finite verb (*verbum finitum*) and the grammatical subject (the subordinate clause) expressed by means of the pronoun *który* "which;"

type 2 — the relation of the nominal predicate (a copular verb followed by the predicative complement) and the grammatical subject *który* "which" in the subordinate clause;

type 3 a, b — the relation of the (non-expressed in *N*) verbal predicate and the grammatical subject (a noun in the nominative case) of the adverbial clause of place;

type 3 c, d, e, f, g, i — the relation of the (non-expressed in *N*) verbal predicate in the form of an impersonal verb (3rd person plural and the implicit ontological subject *ludzie* "people") with the object (a noun in the accusative case) in the adverbial clause of place;

type 3 h — the relation of the verbal predicate in the form of an impersonal verb (3rd person plural and the implicit ontological subject *ludzie* "people") in the adverbial clause of place;

type 4 — the verbal predicate in the form of an impersonal verb (3rd person singular);

type 5 — the nominal predicate in the form of a copular verb followed by the predicative complement.

The morpho-syntactic relations within the discussed *E*s are illustrated by means of a symbolic notation. The symbols are abbreviations of Latin

terms for particular classes of parts of speech and some of their grammatical categories:

"*Sub*"   — the noun in the defined element of E;

"*Sub$_1$*"   — the noun in the nominative case in the defining element of E;

"*Sub$_4$*"   — the noun in the accusative case in the defining element of E;

"*Vprs*"   — the verb in the finite form (the so called *verbum finitum* that determines the grammatical subject);

"*Vimprs*"   — the verb in the impersonal form (3rd person singular or 3rd person plural) that does not imply the grammatical subject, but an implicit ontological subject;

"*C*"   — the copula "is;"

"*Adj*"   — the adjective in the function of the predicative or the attributive;

"*Pron*"   — the pronoun *który* "which;"

"*Pron$_{praep}$*"   — the prepositional expression *w (na, po) którym* "in (on, after) which;"

"*Conj*"   — the conjunction *że* "that;"

" ŕ"   — the double angle quotation marks encompassing the whole E;

"[ ]"   — the square brackets encompassing the defining element of E;

"( )"   — the round brackets encompassing elements introduced by the interpreter, that is, elements that are not signalized by the morphemes of N;

"*P*"   — the relation of predication;

"*Nom*"   — the *nomen* (as opossed to the *verbum*);

"*D*"   — the relation of determination;

"*I*"   — the first symbolism of grammatical relations

"*II*"   — the second symbolism of grammatical relations

"*III*"   — the third symbolism of logical relations.

<p align="center">I</p>

type 1 a, b   *Sub* [(*Pron*) *Vprs*]

type 1 c   *Sub* [(*Pron Vprs*) *Sub$_4$*]

type 2 a   *Sub* [(*Pron C*) *Adj*]

type 2 b   [*Adj*] (*Sub*)

type 3 a, b   *Sub* [(*Pron$_{praep}$ Vprs*) *Sub$_1$*]

type 3 c, d, e, f, g, i   *Sub* [(*Pron$_{praep}$ Vimprs*) *Sub$_4$*]

type 3 h   *Sub* [(*Pron$_{praep}$*) *Vimprs*]

type 4   *Sub* [(*Conj*) *Vimprs*] or [(*Conj*) *Vimprs*]
type 5   *Sub* [(*Conj C*) *Adj*]

Thus formalized *Es* inform us about the semantic structure of word-formation types *N*:

type 1 — names of professionals, the so called *nomina professionis* (e.g. *nomina agentis*, that is names of either agents of actions or professionals who create objects, cf. — *modelarz* "modeller") and names of impersonal instruments, the so called *nomina instrumenti*;

type 2 — names of personal or impersonal owners of properties, the so called *nomina attributiva*;

type 3 — names of various parts of, either open or closed, physical space;

type 4 — names of actions, the so called *nomina actionis*;

type 5 — names of certain sets of properties, the so called *nomina essendi*, that is names of "having a quality."

Types 1-3 are *Ns* of specific classes of objects of extra-linguistic reality. Types 4 and 5 are names of certain classes of abstract concepts (onomatoids). What is characteristic for names of type 1—3 is that their formal structure as if makes them refer to things. Formations with the suffixes *-anie*, *-enie*, *-ość* do not meet this condition as they designate events (that is, actions, courses, processes, states, etc.) or sets of properties.

The central part of relations in the defining element of *E* is the predicate which implies other elements, e.g. determinants of the predicate such as the object, the adverbials, and the element that is required by the predicate, that is, the subject. The defining elements in *E* are mainly predicative constructions, although in some *Ns* that denote the same objects as *Es*, the predicate is not formally expressed by means of one of the word-formation elements. The relation of predication needs, however, to *implicite* lie in the meaning of certain *Ns* since their word-formation bases are the elements that determine the predicate or elements implied by the predicate. Such cases can be illustrated by means of the notation:

II

type 1; type 2 a; type 3 h, type 4   *Sub* [*P*]
type 1 c; type 3 a, c, d, e, f, g, i; type 5   *Sub* [(*P*) *Nom*]
type 2 b — which represents the relation of determination   [*D*] *Sub*

If the semantem[54] of the word-formation base in the defining element of

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[54]Semantem is the term given by linguists to the smallest semantic element of the root or stem of a word.

E is also a word-formation stem of *N*, then the syntactic role of the basic word can be assigned to the stem of this *N*. Thus, names derived from the word-formation base, which functions as e.g. the grammatical object in *E*, can be included in the group of *Ns* that are based on the stem of a noun in the accusative case, and thus — that are in the function of the grammatical object (cf. type 3 c, d, e, f, g, i).

By applying this approach, it is possible to distinguish between groups of *Ns* based on stems of the verb in the function of the verbal predicate, the noun in the nominative case, that is — in the position of the grammatical subject, the adjective in the function of the predicative complement (cf. type 2 a) or in the function of the attributive (cf. type 2 b), etc. In other words — derivatives can be systematized on account of the syntactic position and the syntactic function of their word-formation bases that are expressed *explicite* in syntactic phrases of *E* that are equal to a given *N*.

Logical analysis of internal relations in expressions *E*

From the linguistic point of view, schemas *E* have, as mentioned above, the form of word phrases, while from the point of view of logical semiotics — they are expressions of the form of (indefinite) descriptions. A syntactic phrase and a logical description share certain properties. The logical structure of description, similarly to the linguistic structure of a word phrase, is two-fold; the description consists of an expression which in logic is called a function sign, and the expression that is its argument. The argument, that is the first element as regards the order of occurrence of both syntactic categories, is a name that denotes a class of objects of extra-linguistic reality. Whereas the function sign, that is the second element of description, denotes functions, that is — properties and relations characteristic of sets of objects denoted by the argument name. In other words — the semantic role of the function sign consists in that it is the classification or relation sign of the argument name, that is — such an expression that enumerates properties and relations assigned to objects symbolized by the argument name. The argument of description is an equivalent to the defined element of the syntactic phrase, while the function sign — an equivalent to the defining element.

The structure of description is expressed in logic by means of a formula that consists of signs symbolizing the components of description. Instead of the argument name, the variable "*X*" is used, while the symbol "*f*" stands for the function sign. The expression consisting of the function sign "*f*" and the argument variable "*X*," and thus "(*f*) *X*," is not a complete formula of

description, which requires the operator sign - "η" for indefinite descriptions. The operator - "*eta*" distinguishes a given class of objects from the scope of any other objects. This operator is used to formalize indefinite pronouns (e.g. *ktoś* "somebody," *coś* "something," *jakiś* "a, some") or indefinite articles in ethnic languages that have articles. By binding the free variable "X," the operator "η" transforms e.g. the expression "$(f)\ X$" from a sentence formula to a description formula that describes a given class of objects with certain properties.

This is the general formula of indefinite description:[55]

$$\text{III } "(\eta\ X)f(X)"$$

This formula can be understood as follows: "some X having property f," or "some X that has property f," or "some X that is f-ish."

The syntactic phrase (cf. I, 1—5 and II) and the indefinite logical description (cf. III) are formalized from different points of view. The expressions (I, II) and the expression (III) illustrate different angles of approach to the relations they describe. The formula (III) is a sign of the function-argument relation between expressions that refer to things (or facts) and properties of these objects, while schemas (I, II) represent relations between appropriate linguistic signs.

A confrontation of the descriptive formula (III) with the schemas (I — 1 a, b; 3 h; 4) leads to the conclusion that the logical description (III) and expressions E with predication in the defining element have three signs each (cf. "η," "X," "f" with "Sub," "$Pron$," "V"). However, the formulas (I) and (III) are not isomorphic, since components of the expressions (I) belong to different areas of natural language. These are morpho-syntactic components of word phrase E or morphological components of N (the formant and the stem).

The formula of the function-argument relation does not precisely reflect the internal relations in E, since: 1) these relations are not only of the type function sign — argument relation; 2) the schemas E do not have a linguistic equivalent to the operator — "*eta*," since in everyday Polish indefinite pronouns are omitted. They do not function analogously to indefinite articles. The expressions: *jakiś fakt, że się naucza* "a fact that one teaches," *jakiś fakt bycia sprawiedliwym* "a fact of being just," or *jakiś fakt, że jest sprawiedliwie* "a fact that it is just" would be blatantly artificial. Also, what the formula

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[55]See the formula of definite description with the operator — "*iota*" in Reichenbach (1967: 94).

of the indefinite logical description does not take into account is that the function sign is an expression composed of components which have semantic and syntactic functions and occupy certain syntactic positions.

The symbolism of function calculus is too simplified to be used to interpret relations in polymorphic structures of an inflexional language. An adequate method to analyze internal relations in complex expressions of natural language is K. Ajdukiewicz's interpretation. Ajdukiewicz's interpretation schema is isomorphic for complex sentences that he analyzed.

Discovering the relation of direct syntactic subordination of particular lexical units that compose *E* as well as establishing the role of their elements, and especially the word-formation base *N*, is possible due to applying the method introduced by K. Ajdukiewicz (1967a, b), who used the method to define certain notions which can be also useful in linguistic analyses, e.g. the notion of a proposition as the connotation of sentence, the notion of a translation of sentences of a certain type into other sentences, that is — the notion of transformation. The aim of the method was to interpret syntactically sentences with intensional expressions, analyze semantically intensional expressions and eliminate them from sentences of natural language. In Ajdukiewicz's opinion, the definition of connotation as a set of certain properties, adopted in traditional logic, is not satisfactory.

Because every complex expression (and hence, every sentence) is composed of elements that are organized in a hierarchy, defining the connotation of sentence involves indicating the syntactic positions of sentence elements and defining their syntactic role. Thus understood connotation is a function which establishes the correspondence between syntactic positions of words in the sentence and their denotata. Such correspondence is a proposition asserted by the sentence. In other words, Ajdukiewicz's definition of connotation takes into account not only the objective references of the words that compose the sentence, but also their syntactic position and role. The definition of translation is also based on the notion of syntactic position and the notion of denotation.

There is such correspondence between all elements of the transformed sentences and elements of the output sentence that elements of a given pair of sentences have relatively the same syntactic position and are mutually equal, that is — denote the same objects. According to Ajdukiewicz's views, every binary relation between linguistic expressions can be confronted with a class of ordered pairs of objects between which there is an analogous relation. This idea can be interpreted thus, that relations between pairs of linguistic signs reflect relations between designates of these signs. Some of

Ajdukiewicz's conceptions summarized here confirm certain intuitions of mine about linguistic interpretation of factual material.

N as a uniform linguistic sign meets the whole of denotative and connotative functions. The question arises if, and possibly how, these functions are realized by elements of *N*. The other question is what is the syntactic relation between the derivative and its word-formation base. In other words — if the relation is direct, or not. In order to answer these questions, I interpret some word-formation facts using the mentioned method for analyzing complex sentences.

As mentioned above, expressions *E* do not have operators which bind variables. However, it is possible to distinguish in each of the expressions representing a certain word-formation type the main operator and its consecutive arguments, from which one is the base word for *N*.

It is considered that the main operator is such a word that together with its argument constitutes the whole complex expression. The argument of the main operator and the operator itself are elements of the first degree in *E*. There are such arguments of the main operator that have structures composed of elements of the first, second, third and n degree. A description of the relation between *N* and its word-formation base consists in determining the syntactic position of the base word in *E* and the element of which degree this base is. Establishing the syntactic position of the base word by means of ordinary language would be a too complicated description. Thus, following Ajdukiewicz, I introduce the arithmetic symbolism which enables to show distant positions occupied by certain base words more clearly.

Natural numbers symbolize elements of *E*: "1" is the symbol of the whole expression *E*; "1,0" — the symbol of the main operator; "1,1," "1,2," etc. — the symbols of consecutive arguments. Numbers "1,1," "1,0," "1,2" stand for syntactic positions of the first degree; "1,2,0," "1,2,1" — of the second degree; "1,2,1,1," "1,2,1,0" — of the third degree.

There are two interpretation variants in the analysis of expressions *E*. The first is based on the analysis of structures of subordinate clauses, in which verbs together with conjunctions function as main operators. Cf. the sentence quoted by Ajdukiewicz:

"Caesar believed that the Capital of Republic lies on the Tiber"

			1,1,0	1,1,1	1,0	1,2
1,1	1,0		1,2	1,3	1,4	1,5

By analogy to the above example, I assume that the main operator of *E* is the verb together with the accompanying pronoun *który* "which," or the

expression *w którym* "in which," cf.:

1) malarz   człowiek malujący → człowiek, który maluje[56]
                    1,1   1,0   1,1   1,0

2) śmiałek   człowiek, który jest śmiały[57]
                    1,1   1,0

3) modelarz   człowiek wytwarzający modele[58] →
                    1,1   1,0
              → człowiek, który wytwarza modele[59]
                     1,1   1,0
                      1,0,0   1,0,1

4) wrzosowisko   miejsce, na którym rosną wrzosy[60]
                    1,1   1,0
                     1,0,0   1,0,1

5) równina   obszar mający powierzchnię równą[61] →
                    1,1   1,0
            → obszar, który ma powierzchnię równą[62]
                1,1   1,0
                    1,0,0   1,0,1

The other possibility of interpretation is also a certain attempt at applying Ajdukiewicz's method, that is, such in which the main operator is not the verb with the pronoun (or the conjunction), and thus not the exponents of the relation between elements of *E*, but a noun in the defined element of the syntactic phrase *E*. What can be such a relation element is the word *miejsce* "place," the word p*rzedmiot* "object," etc. that informs that the expression (the defining element), which asserts something about a feature or property, remains in relation to something which has a meaning of locativity, objectship, etc. Generally, the functions of operators are taken over by unautonomous words, thus in such a case operators are relativized to a given expression. The precedent can be the fact that Ajdukiewicz assigned the role of the operator to a noun, cf.:

[...] the Capital of Republic [...]

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[56]"painter" "painting person" → "person who paints"

[57]"daredevil" "person who is daring"

[58]"modeller" "person making models"

[59]"person who makes models"

[60]"moor" "place where heather grows"

[61]"plain" → "area having a flat surface"

[62]"area which has a flat surface"

<div style="text-align:center">

1,1,0   1,1,1

</div>

From all nouns in the defining element in *E*, the most appropriate for the role of the operator is the word *miejsce* "place" because of its occasional character. This word is not actually used outside the context or an extra-linguistic situation; it can only occur in some complex expressions. For this reason it can be considered unautonomous.

By analogy, what are main operators are other nouns, e.g. *człowiek* "person," *przedmiot* "object," *fakt* "fact." Compare the following examples:

1) człowiek, który maluje[63]
    1,0   1,1

2) człowiek, który jest śmiały[64]
    1,0   1,1
            1,1,0   1,1,1

3) człowiek, który wytwarza modele[65]
    1,0   1,1
            1,1,0   1,1,1

4) miejsce, na którym rosną wrzosy[66]
    1,0   1,1
            1,1,0   1,1,1

5) obszar, który ma powierzchnię równą[67]
    1,0   1,1
        1,1,0   1,1,1
              1,1,1,0   1,1,1,1

6) miejsce, które znajduje się przed mostem[68]

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[63]"person who paints"

[64]"person who is daring"

[65]"person who makes models"

[66]"place where heather grows"

[67]["area which has a flat surface"] The expression *obszar, który ma powierzchnię równą* "area which has a flat surface" (cf. 5) can be considered an equivalent to the expression: *obszar, którego powierzchnia jest równa* "area whose surface is flat." This expression can be interpreted in a different way, e.g.:

obszar, którego powierzchnia jest równa

"area whose surface is flat."

1,0   1,1
    1,1,1   1,1,0

The interpretation (5) is more convenient as it indicates which degree of the main operator's argument the base word is for the formation *równina* "plain."

[68]"place which is in front of a bridge"

(a) 1,0   1,1
                   1,1,0   1,1,1
miejsce, które znajduje się przed mostem
(b) 1,0   1,1
                   1,1,0   1,1,1

In the expression (a) the preposition belongs the operator, while in the expression (b) to its argument. Adopting the interpretation (a) is justified by the fact that the schema (a) agrees with other expressions interpreted according to the second variant of logico-syntactic analysis. For here the relation of transformation is analogous to the relation e.g. in the schema: *malarz* "painter" → painting personŕ → person who paintsŕ; *przedmost* || *przedmoście* "forebridge" → place being in front of a bridgeŕ → place which is in front of a bridgeŕ.

These schemas as wholes are treated as one-argument expressions. The arguments of expressions *E* have a complex structure and undergo further decomposition. The proposed interpretation is closer to linguistic analysis than the one presented as the first variant based on Ajdukiewicz's method. It preserves the dichotomy distinguishing between constructions of natural language and indicates the parallelism between the main operator, the defined element in the syntactic phrase and the formant *X*.

Conclusions

The usefulness of the interpretative method proposed in this article is illustrated by the following examples:

1) The word *kartoflisko* "potato field" has an analogous structure to the word *truskawkarnia* "strawberry field," although both *Ns* refer to different designates and differ in formants. Cf. *kartoflisko* → *miejsce, na którym uprawiają(-ali) kartofle* "place where potatoes are (were) grown," *truskawkarnia* → "place where strawberries are (were) grown."

Ns: *kartoflisko* "potato field" and *wrzosowisko* "moor" have an analogous, though not identical word-formation structure, since they are formed by means of the alternation formants *-isko* || *-owisko*. Whereas they differ in semantic structures. The word-formation stem of the *N wrzosowisko* is a noun in the nominative case, and thus in the function of the grammatical subject. Thus, the relation of the *N wrzosowisko* to its word-formation stem is different than the relation of *kartoflisko* to the base *kartofle* "potatoes." Hence the conclusion that *Ns* with analogous, though not equal formal structures are not identical on account of the semantic structure. This fact

is confirmed by the logico-syntactic analysis. The numerical symbolism of expressions *E* shows that the relation of the base word to its derivative can be a relation of the first, second, third degree.

2) The syntactic position of word-formation bases shows that *Ns* classified in the same word-formation category or the same semantic-structural type are not homogeneous in many cases. These can be e.g. derivatives based on the stems of parts of speech in the function of the sentence elements of the first degree, that is — the subject and the predicate, or formations based on the stems of parts of speech in the function of the sentence elements of the second degree, that is — the attributive and the object, etc.

The numerical method illustrates that names derived from nominal bases (of nouns, adjectives) have a more complicated semantic structure than deverbal derivatives. Hence, the method frees the interpretation from intuitive decisions on categoriality and regularity of word-formation structures.

3) A comparison of the formal structure of a given *N* and its semantic structure enables us to determine the function of the formant and the stem of *N*.

The formant is an equivalent to the defined element of the syntactic phrase. The defined element denotes a certain class of objects of the objective world, thus the formant signalizes the denotation of a given *N*.

In expressions interpreted by means of logico-syntactic method, the defined element functions as the main operator of one name argument. Thus, the formant has an analogous function to the main argument. Since certain operators have, among others, the property that they transform expressions into other expressions, the structural function of the formant is close to the function of the operator. The formant transforms the base word that belongs to a certain class of parts of speech into a formation that belongs to a different class of parts of speech, and thus nominalizes e.g. adjectives, verbs. In the case of *Ns* derived from nouns, the formant does not change the category of its word-formation base, but changes its denotation (cf. *kwiaty* "flowers" : *kwiaciarnia* "florist's," *modele* "models" : *modelarz* "modeller"), that is — gives the derivative a different meaning that the one the base word has, or stylistically modifies the meaning of the derivative (cf. *pies* "dog" : *psisko* "large dog," *kot* "cat" : *kocina* "poor little cat").

The stem, as an equivalent (and more precisely, a predictor) of the base word in the defining element of the syntactic phrase, classifies and specifies the objects denoted by the whole *N* by enumerating specific properties of these objects. Thus, this is what its semantic function, which J. Rozadowski (1904: 56) and W. Doroszewski (1952: 308) termed as distinguishing, consists

in.

The semantic-syntactic role of the stem can be characterized in such a way that it cumulates the functions of lexical components of the defined element in the word phrase. These functions are: syntactic functions of conjunctive pronouns (i.e. relative pronouns) and functions of morphological exponents (e.g. inflexional endings) of lexical units. In other words, the stem is a "mixture" of all the semantic and syntactic functions of N, which are expressed in N through formal means or which do not have morphological exponents in its formal structure. The stem is the element of N which signalizes its connotation.

The relation of the formant and the stem is analogous to the logico-syntactic relation of the main operator and its argument.

These remarks are not ultimate conclusions resulting from the analysis of word-formation material. Many issues should be discussed in greater detail. Also, the ideas presented here need revision. However, solving problems that arise in word-formation was not the aim of this article. The aim was to show that at least some of the issues are solvable by application of certain methods of logical semiotics. These methods may help to explain the facts of natural language that cause controversies. Further attempts to use Ajdukiewicz's theoretical conceptions may lead to other results than the ones already signalized.

Ajdukiewicz's papers that mainly contributed to this article were published after his death. He did not finish his research on the issues of syntactic analysis of sentences in natural language. He only presented the possibilities of this analysis, while the fact that I applied his method to interpret linguistic phenomena of a different kind further attests the potential of this method.

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