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Editor-in-Chief of *Studia Semiotyczne*:

Jerzy Pelc

Assistant Editors of

Studia Semiotyczne — English Supplement:

Katarzyna Kuś

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Witold Wachowski

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Proofreading:

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Typesetting:

Tadeusz Ciecierski

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Contents

Łukasz Plesnar <i>Introduction to the Semiotics of Acting</i>	4
Andrzej Łachwa <i>Semiotics of Address Phrases</i>	23
Kazimierz Trzęsicki <i>The Semantic Category of Tense Operators</i>	39
Urszula Żegleń <i>Ontological Issues in Non-Classical Logic</i>	66
Jacek Juliusz Jadacki <i>On Criteria of Truthfulness</i>	108
Anna Jedynak <i>The Notions of Truth and Thesis in Ajdukiewicz</i>	128
Jerzy Pelc <i>On the Concept of Lie - From the Point of View of Semiotics</i>	158

Łukasz Plesnar

INTRODUCTION TO THE SEMIOTICS OF ACTING

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1. DIFFERENCES IN THE STATUS OF ACTING IN THEATRE AND FILM

According to a wide-spread conviction, theatre and film acting systems are two relatively independent phenomena, differentiating from each other both with respect to their internal structure, as well as their function. Attempts have been made to indicate the various sources of this dissimilarity, M. Ciaureli, for example, wrote that:

in theatre [...] real live people – the actors – move and act in a real three-dimensional environment. The final result of a cinematographic realisation is, instead, the film on which are imprinted the reproductions of men and of objects; these, although arranged in perspective, are in the last analysis fixed on a flat surface. They are photographed in such a succession that, reproduced on screen, they seem to move, but always within the limits of a flat surface. (after Bettetini 1973: 81)

One might risk an opinion that the basic differences between theatre and film acting styles result from dissimilar positions, which these systems have in the theatre and in film. In the first case acting is an element of the so-called presenting stratum, whereas in the latter, it is an element of the so-called registered stratum. The above assertion is based on the assumption that from a semantic point of view, each work of art is a complex object, containing at least three strata (a) the presenting stratum, (b) the presented stratum, and (c) the communicated stratum. With respect to films, one

should add one more factor, i.e. the registered stratum (cf. e.g. Plesnar 1980: 27).

The presenting stratum may be described as what we see on stage or on screen, or – to be more precise – as an idealised, schematized material object with the character of a sign (or a collection of such objects). This stratum constitutes the most important element of a work of art, making all other elements of the work of art dependant on it. The remaining strata are not directly present in the work, but are merely a kind of theoretical construct.

In the case of film, the presenting stratum is tantamount to the dynamic system of colourful or black-and-white spots and lines, as well as verbal and non-verbal sounds (rustle, music). In theatre the presenting entities are i.a. the actors, their actions, utterances, props, stage design, etc.

The registered stratum (appearing only in films, photography and television) constitutes the reconstructed (on the basis of the prerequisites provided by the presenting stratum) actual (physical) reality, recorded on a film, photographic or television tape. This reality comprises all kinds of existing physical objects, phenomena and processes, which such objects and phenomena are subject to.

The presented stratum, being an equivalent of Ingarden's stratum of presented objects and their faith (Ingarden 1960: 52-53, 281-349) contains the characters played by the actors, words uttered by these characters, all of their gestures and actions, the objects "played" by the props, decorations, etc. This stratum covers also such components of a work of art as the story and the plot; with respect to this stratum it is possible to speak of the so-called content of the work of art (within a certain special meaning of the term, discussed by Roman Ingarden in §4 of his work titled *O formie i treści dzieła sztuki literackiej* (Ingarden 1966: 379-394)). In a few words, this stratum covers what is in the classic study of literature, and therefore also in film and theatre study, and has become known as the represented world, which is understood as heterogeneous intentional reality, brought to life by the author and reconstructed by the recipient.

The communicated stratum on the other hand covers the essence or the idea of the work, i.e. a certain state of affairs (or a complex state of affairs) communicated by the abovementioned strata, in particular by the presented stratum.

The fact that the acting systems in theatre and film are factors belonging to different strata of the work of art results in a series of consequences. Since these consequences are, above all, of an ontological character, we will not look into them in detail. From the point of view of semiotics, any and all

actual dissimilarities between theatre and film acting will prove relatively insignificant, if we assume that apart from the communicated stratum, the remaining strata of the work of art are constructed of signs. Therefore, we may claim that both the theatre acting system and the film acting system use signs, or to be more precise, meaningful actions. Such actions constitute and/or represent relevant qualities within the presented stratum, and indirectly also in the communicated stratum. There are however two contradictory ways of such constitution and representation, depending on the fact of whether we are considering the presented or the communicated stratum. The relation between the presenting stratum (in the case of the theatre) or the registered stratum (in the case of the film) and the presented stratum may be treated as isomorphic (cf. Plesnar 1980), whereas the relation between these two first strata and the communicative stratum is of totally different character.

A few examples will allow us to explain the essence of the issue. Let us imagine the following actor's behaviours: "crying," "laughing," "raising a hat," "saying *I love you*," "shooting someone," etc. In the realm of presented reality they represent analogous behaviours of a character, i.e. "crying," "laughter," "raising a hat," "saying *I love you*," "shooting someone," etc., in the realm of the communicated stratum they constitute special units of meaning: "despair," "joy," "greeting," "love," "aggression," etc.

Obviously, units of meaning from the communicated stratum cannot always be unambiguously ascribed to the particular actions of an actor. In my opinion, such a state is caused by two things. Firstly, the relations between the actions of an actor and the relevant units of meaning are in majority the so-called fuzzy functions (this notion will be discussed later on). Secondly, some of the actions of an actor do not have their equivalents in the communicated stratum, but only in the presented stratum. This pertains for example to such actions as: "hammering a nail into a wall," "getting dressed," "cooking" or "sleeping," although these actions as well may denote (in special circumstances) specific units of meaning from the communicated stratum, e.g. "impatience," "irritation," "hunger," or "drowsiness" (this happens only if the analysed actions have certain special features). One may however adopt a rule that in the above cases, these acting actions characterise only the presented characters, and do not denote anything in the communicated stratum.

2. FORMAL MODEL OF ACTING AS A COMMUNICATION SYSTEM

The principal purpose of this study is to construct a formal model of

the acting system (with respect to both theatre and film acting). We will thereby refer to the theory of fuzzy sets developed by L. A. Zadeh (1965, 1971, 1978), R. E. Bellman (Bellman, Zadeh 1970), J. Goguen (1976), H. W. Gottinger (1974) and others, as well as to the theory of actions formulated by M. Nowakowska (1973a, 1973b, 1973c, 1980), and also the papers of the latter author pertaining to the so-called multidimensional language of communication (1979, 1980).

According to our first assumption, acting constitutes a complex communication system, containing several sub-systems, i.e. using M. Nowakowska's terminology, using several media of communication. The system of acting defined in the above way, may be described as the following structure:

$$\langle M, V, \#, L, S, f \rangle,$$

where the symbols have the following meaning: $M = \{m_1, \dots, m_k\}$ is a set of communication subsystems constituting the acting system, i.e. a set of communication media applied by this system; V is the "alphabet" of the actions, $\#$ is a pause, L is a multidimensional language of communication; S is a set of meanings, f is the membership function representing the fuzzy semantics of language L (in the communicated stratum, since within the presented stratum the membership function is not of fuzzy character).

Usually M is a five-element set, i.e. it is divided into five different subsystems (media) of communication: utterances, intonation, facial expressions, gesticulation, and certain *quasi*-natural actions, such as crying, weeping, laughter, granting, etc. We need to understand that the notion of "gesticulation" should be understood very broadly, referring to the entire motor activity of the actors.

In case of particularly conventionalised theatrical forms (certain types of traditional Chinese and Japanese theatre), it is convenient to extend the M set, either by dividing its categories into subclasses (e.g. by splitting the class of gesticulation into separate subclasses – gestures of the head, arms, hands, fingers, etc.), or by introducing new elements – face painting, masks, etc.

Set V includes all actions performed with the use of various communication subsystems, and moreover contains both utterances, as well as intonation, facial expressions, gesticulation and certain *quasi*-natural actions. In order to simplify our deliberations, we do not take into account the t function ascribed to each action from set V , expressing the duration of such action. Such an operation is admissible, on the assumption that each element of set V lasts for a unit of time, and longer actions are treated as concatenations of the actions.

The pause, marked with “#” is considered to be one of the actions from set V , and is interpreted depending on the context in the following manner: with respect to an utterance it is interpreted as silence, with respect to intonation it is interpreted as “neutral” voice timbre, with respect to facial expressions it is interpreted as a lack of such expressions, with respect to gesticulation it is interpreted as the neutral position of arms, legs and other parts of the body, and with respect to *quasi*-natural actions it is interpreted as a lack of such. As M. Nowakowska rightly observed, designation of various actions with the use of the same symbol does not result in misunderstandings, since the form of notation is always decisive for the type of communication subsystem, to which a given symbol pertains.

From the formal point of view, L , i.e. a multidimensional language of communication, constitutes a subset of class of parallel sequences of actions performed on various media. It may also be described slightly different, as a structure of special communication units constituting a set of simultaneously performed actions. Such units are called by M. Nowakowska *gesturowords* and defined as function $h: M \rightarrow V$, i.e. a function ascribing an action from the V set to each medium. Thus, h is a set of actions $v_1 = h(m_1)$, $v_2 = h(m_2)$, $v_k = h(m_k)$, interpreted as simultaneous performance of action v_1 on medium m_1 , performance of action v_2 on medium m_2 , . . . and action v_k on medium m_k .

The set of all *gesturowords* shall be marked with the symbol H .

Set H contains a plurality of various elements. Only a part of them is acceptable in view of the requirements of the theatre and film communication, the remaining H -components cannot serve as communication units of the acting system. It seems that there are two reasons for this. Firstly, H includes many nonsensical *gesturowords*, ascribing given actions to inadequate media, e.g. the utterance *farewell* to the medium of gesticulation or the action “bow” to the medium of facial expressions. Secondly, some *gesturowords* are inadmissible in view of the acting conventions applicable in particular theatre and film forms. And thus, for example, the Kabuki theatre does not permit “spontaneous” gesticulation, traditional theatre excludes the gestures present in the pantomime, and contemporary film acting does not allow the use of suggestive facial expressions, as were present in the expressionistic cinema.

In connection with the signalised circumstances, one needs to eliminate from H *gesturowords*, which are inadmissible and to specify the sets of actions relevant for the particular media. For this purpose one needs to employ the notion of multidimensional language of communication L . We

therefore need to consider class H^+ of all finite sequences $u = h_1 h_2 \dots h_n$ created from set H elements. Such sequences have the form of the following matrix:

$$u = h_1 h_2 \dots h_n = \begin{bmatrix} v_{11} v_{12} \dots v_{1n} \\ v_{21} v_{22} \dots v_{2n} \\ \dots \\ v_{r1} v_{r2} \dots v_{rn} \end{bmatrix}$$

where v_{ij} means an action on medium m_i performed by gestuoword h_j , i.e. $v_{ij} = h_j(m_i)$.

Formally speaking, L is a subset of H^+ , i.e. it is a set of matrixes of actions of the above shape. The components of L are interpreted as admissible sequences of gestuowords, i.e. admissible communication actions.

The proposed procedure is, of course, not aimed at the creation of an algorithm, which would enable the determination of which sequences of gestuowords, as admissible, belong to L . This would be a truly unfeasible task, which is understandable, in particular, if we realize that it is impossible to construct a similar algorithm in a much simpler situation, i.e., when L is a natural language.

In consequence, the admissibility of sequences of gestuowords should be specified in a descriptive way. We will therefore say that a sequence is admissible if: (1) it may be physically performed and (2) it is tolerated in a particular acting convention. As a result, one is bound to state that in different theatrical and film forms different sequences of gestuowords are admissible.

Let us now define the set of all admissible gestuowords (marked with letter G), i.e., in other words, a set of all units which may appear in the matrixes of actions belonging to L :

(D1) $G = \{h \in H: \text{there is such } u = h_1 \dots h_n \in L \text{ for which } h = h_1 \text{ by a certain } j\}$.

Let us also introduce a definition of set L_i , of all i verses belonging to the matrix from L , i.e. a set of sequences of action which may appear in the i medium:

(D2) $L_i = \{v_i \dots v_n: \text{there is such } u = h_1 \dots h_n \in L \text{ for which } h_1(m_i) = v_1 \dots h_n(m_i) = v_n\}$.

Now, let us specify set V_1 for all actions which may appear in sequences from L_i i.e. a set of actions performable on medium m_i :

(D3) $V_i = \{v = V: \text{there is such } u = h_1 \dots h_n \in L \text{ for which } h_j(m_i) = v \text{ by a certain } j\}$

The definitions presented above bring the two most important con-

sequences determining that an admissible sequence of gesturowords may include only the admissible gesturowords and that an admissible gesturoword must in each medium have an action admissible for such a medium. Formally, these theorems may be expressed in the following manner:

- (1) if $u = h_1 h_2 \dots h_n \in L$, then $h_i \in H$ ($i = 1 \dots n$);
- (2) if $h \in G$ and $h(m_i) = v$, then $v \in V_i$ ($i = 1 \dots n$).

It needs to be emphasized that the reciprocals of the above implications are not true. The reasons seem obvious. In the first case, even if each of the gesturowords is admissible, a sequence of such gesturowords may be inadmissible. For example, it is possible to greet someone by saying: *Good morning, Hello, Cheers, How do you do, Hi*, yet saying all of these expressions in a row will render them an inadmissible sequence. In the second case, a gesturoword may include actions, which – each individually – are admissible, but together are impossible to perform simultaneously. It is for example impossible to utter several different sentences at the same time.

Since acting communication is a multidimensional system, one needs to introduce notions describing syntactic relations between various media. These relations – called forcing and exclusion – refer to situations when certain actions performed on a given medium are implied, and others are excluded by the fact that a given action is performed on another medium.

Firstly, let us define set $B_i(v)$ of all admissible gesturowords, which have action v on medium m_i :

$$(D4) \ B_i(v) = \{h \in G: h(m_i) = v\}$$

Further, let us determine the relations of forcing (R) and exclusion (P):

The definition of relation R is as follows:

$$(D5) \ uR_{ij}v \equiv [h \in B_i(v) \rightarrow h(m_j) = u].$$

The definition of relation P is as follows:

$$(D6) \ uP_{ij}v \equiv [h \in B_i(v) \rightarrow h(m_j) \neq u].$$

According to definition (D5) action u forces action v , if and only if each of the gesturowords which have action v on medium m_i , also have action u on medium m_j . Further, according to definition (D6) action u excludes action v , if and only if a gesturoword having an action v on medium m_i , cannot have action u on medium m_j .

From the formal point of view, the relation of forcing is transitory, although not necessarily symmetrical (e.g. in certain film forms the sentence *I'm afraid* requires relevant gestures and facial expressions, however an opposite relation does not need to take place). On the other hand, the relation of exclusion is symmetrical, although not necessarily transitory (e.g. the sentence *I'm afraid* usually excludes smiling, and smiling excludes

shaky hands but the sentence *I'm afraid* and shaky hands may appear simultaneously).

It is easy to notice that the relation of forcing is much less common than the relation of exclusion. This frequency may be reversed in case of highly conventionalised theatrical or film forms (Kabuki spectacles, medieval mysteries, burlesques from 1920s, traditional westerns, etc.), yet the general trend is invariable.

3. SEMANTICS OF THE ACTING SYSTEM

As we have already mentioned, the last two elements of the acting system are the set of meanings of particular actions from language $L(S)$ and membership function f , describing how the meanings are ascribed to language L elements.

Neither set S , nor function f are homogeneous. Within S it is possible to distinguish two sub-sets: the set of meanings – elements of the presented stratum (marked with symbol S_p) and the set of meanings – elements of the communicated stratum (marked with symbol S_k).

Analogically, we need to speak not of one, but of two membership functions. The first function (let us call it the presentation function and mark it with the symbol f_p) ascribes S_p elements to L components. The second function (let us call it the communication function and mark it with the symbol f_k) ascribes elements of S_k to L components. The principal difference between the presentation function and the communication function consists in the fact that f_k unlike f_p is a fuzzy function.

We now need to explain the notion of fuzziness.

Although the idea of fuzziness may appear somewhat elusive, it is a perfectly tractable mathematical concept. The fuzzy sets theory can be thought as a mathematical model for imprecise concepts. A fuzzy set is a membership function which describes the gradual transition from membership to nonmembership. Of course the relationship fuzzy set-membership function is a subjective one. It is plain that this assignment is governed at his turn by another membership function. Odd enough, the model seems to be imprecise. However, the process can be carried out. More exactly to each fuzzy subset of a set X we can assign any membership function from the set of all membership functions, denotes $F(X)$. Thus, a deeper insight can be gained considering $F^2(X)$, etc. This fuzzification process leads to an universal object. The major premise of this approach is that it is often possible to understand and to express inexactness in mathematical terms. (Negoitǎ, Ralescu 1975: 10).

Using a more precise notation, we may ascertain that the following

function is a fuzzy subset from set X :

(D7) $g: X \rightarrow [0,1]$.

Within $F(X)$, i.e. in the set of all membership functions, the following operations are defined:

(D8) sum: $(g \vee g')(x) = \max(g(x), g'(x))$

(D9) product: $(g \wedge g')(x) = \min(g(x), g'(x))$

(D10) complement: $\bar{g} = 1 - g(x)$

(D11) Two fuzzy sets g and $g' \in F(X)$ are identical if and only if

$$g = g' \equiv g(x) = g'(x). \forall x \in X$$

We may now consider the notion of a fuzzy function. There are two methods of defining this function.

According to the first definition, a fuzzy function specified on elements of set x and of values from set y , marked with symbol $f_f: X \sim Y$, is the following projection:

(D12) $f_f: F(X) \rightarrow F(Y)$

Therefore, f_f binds each fuzzy subset from set Y with each fuzzy subset from set X .

In order to formulate an alternative definition of a fuzzy function, we need to resort to the notion of relation, understood as subset R of the Cartesian product $X \times Y$ of two spaces, X and Y , having, respectively, elements x and y . A characteristic feature of the function is that it is one-dimensional, i.e. the fact that each element x from set X is assigned one, and only one element y from set Y . Therefore, a fuzzy function described by the elements of set X and of the value of set Y , may be found identical to the fuzzy subset of the Cartesian product $X \times Y$.

(D13) Therefore $f_f: X \times Y \rightarrow [0,1]$ or $f_f \subset F(X \times Y)$.

Please note that function $f_f(x, y)$ may be treated as a degree of membership of y in image x in accordance with f_f , or as the intensity of the relation between x and y .

The notion of a fuzzy function is of great importance for us, since function f_k assigns meanings to the elements of the multidimensional language of acting communications meanings – components of the communicated stratum, is exactly of a fuzzy character.

From the formal point of view, f_k is a function projecting the $L \times S$ set in the $[0,1]$ range:

(D14) $f_k: L \times S \rightarrow [0,1]$,

i.e. assigning to each pair $(u, s) \in L \times S$ a number designated by $f_k(u, s)$.

This number represents the degree to which the sequence of gesturowords denotes $s \in S_k$.

Set S_k (within the field of the communicated stratum) contains two types of meaning: the meanings of the utterances and the meanings conveyed by the non-verbal media. The meanings of the latter kind are identical to the already mentioned units of meaning such as “excitement,” “impatience,” “fear,” “weariness,” “contempt,” etc. What is peculiar about these units is that they may be manifested in various modalities. Set S_k covers such elements as “slight excitement,” “excitement,” “extreme excitement,” etc. Therefore, the S_k elements, represent various intensities of meaning s , and constitute a linear scale, i.e. are ordered on a certain continuum.

By the analysis of function f_k , we need to make three material remarks. Firstly, f_k , assigns meanings not only to sequences of gesturowords, but also to single gesturowords. Secondly, gesturowords cannot be presented as too small units; in particular no fragment of a gesture can be treated as a whole gesture, i.e. an element of set V . Thirdly, the fuzziness of function f_k , i.e. the fact that the extent to which gesturoword h expresses meaning s , is equal to p] (in symbols: $f_k(h, s) = p$), may be interpreted in many different ways. M. Nowakowska presents four such interpretations.

According to the first interpretation p is the fraction of people who, when asked about meaning h , answered that it is identical to s .

The second interpretation assumes that s is one of the possible meanings of gesturoword h , and p is the frequency of situations, when h is used to designate s .

According to the third interpretation, p is the level of certainty (manifested by a given person in specific circumstances) that gesturoword h has been used to express s .

Finally, the fourth interpretation is connected with the following conceptualisation of the notion of the gesturoword:

Generally, h consists of an utterance, i.e. an action in the verbal medium, and of a certain number of actions in other media, concerning gestures, facial expressions, etc. With respect to the latter, there is a certain freedom of the use thereof, within the limits of the human body and the surrounding space. One may attempt to describe this formally, by application of a relevant parameterisation of h , i.e. by treating h as an entire family of gesturowords h_z , where z is a kind of a parameter. Various h_z , differ with respect to the extent to which particular gestures and intonations, etc. are emphasized. As z changes so does gesturoword h_z , as well as its meaning. As a typical example, we may mention here the change of the meaning by exaggeration

of certain moves and/or intonations, i.e. the case when z assumes extreme values. By this interpretation function f represents a fraction of those values of z , for which z is the meaning of h_z . (Nowakowska, 1979: 187).

Let us now consider the role played by particular actions in the process of construction of the meaning of a given gesturoword. The most efficient method consists of the comparison of two gesturowords differing only on the level of one medium. By marking gesturoword h with symbols h_i^v and h_i^w , when it is modified in such a manner that actions v and w are performed in medium m_i , then, provided that all other actions remain the same, we may ascertain that:

(D15) action v expresses meaning s to a larger degree than action w , if and only if

$$f_e(h_i^v, s) > f_e(h_i^w, s);$$

(D16) action v expresses meaning s to a smaller degree than action w , if and only if

$$f_e(h_i^v, s) < f_e(h_i^w, s);$$

(D17) action v expresses meaning s to an analogous degree as action w , if and only if

$$f_e(h_i^v, s) = f_e(h_i^w, s);$$

One needs to bear in mind that the relations of expression to a larger degree than..., to a smaller degree than..., and to an analogous degree as..., are relative, and depend both on gesturoword h , as well as on meaning s . It is easy to imagine a situation when v expresses s to a greater extent than w in context h' , but to a smaller extent in context h . On the other hand in the same context h , v may express meaning s_1 to a larger extent than w , and meaning s_2 to a smaller extent than w . We are dealing with such an instance when, for example, h = "greeting," v = "hug," x = "bow," s_1 = "cordiality" and s_2 = "respect."

Assuming that action w is tantamount to a pause, we may introduce further definitions (for the sake of clarity we will limit ourselves to verbal definitions, moving the symbolic formulas to the footnotes). We will namely say that in context h :

(D18) action v sustains meaning s , if replacing v with a pause lessens the degree to which s is being expressed;

(D19) action v generates meaning s , if replacing v with a pause totally excludes the possibility to express s ;

(D20) action v impedes meaning s , if replacing v with a pause increases the degree to which s is expressed;

(D21) action v frustrates meaning s , if replacing v with a pause results in creating of s , which would not appear in different circumstances;

(D22) action v is neutral towards meaning s , if replacing v with a pause does not change the degree to which s is expressed;

(D23) action v is immaterial for meaning s , if the above condition is met, and additionally the degree of expression of s is equal to zero.¹

And here is a bunch of examples:

Sustaining: Crying or laughter accompanying other actions sustain such meanings as, respectively, “despair” or “happiness.”

Generating: In highly conventionalised films from the 1920s, an actor curling up a moustache or stroking a pointy beard generated the meaning of “meanness,” “promiscuity” or “debauchery.”

Impeding: In traditional western films the sharp facial expressions of an actor usually impeded such meanings as “manliness” or “courage,” whereby keeping a straight face, i.e. an almost total lack of any facial expressions was considered to be a synonym of manliness, bravery and valour.

Frustrating: Obscene behaviours, rude statements and vulgar gestures frustrate such meanings as “good manners,” “courtesy” and “refinement.”

Neutrality: The following sentences: “I’m angry with you” or “You annoy me” and a reproachful silence are neutral with respect to such meanings as “outrage,” “discord” or “grudge.”

Immateriality: A smile or lack thereof are immaterial for such meanings as “wisdom,” “nobleness” or “elegance,” since they do not affect the generation of these meanings.

Let us now consider a situation when the meaning is a result of simultaneous co-operation between two different actions on two different media. Let us say that in context h :

(D24) actions u and v are positively associated by sustaining meaning s , if both u as well as v sustain s , but both of them together sustain s to a larger extent than each of them separately;

(D25) actions u and v are positively associated by impeding meaning s , if both u as well as v impede s , however both of them together express s to a smaller extent than each of them separately;

(D26) actions u and v are negatively associated by sustaining meaning s , if both u as well as v sustain s , however both of them together express s to a smaller extent than each of them separately;

(D27) actions u and v are negatively associated by impeding meaning s , if both u as well as v impede s , but both together express s to a greater extent than each of them separately;

(D28) action u catalyses action v , if v does not express s at all, unless it is accompanied by u .²

Certainly, one may consider more complex situations, when meaning is the effect of the joint operation of three, four, five, \dots , n various actions performed, respectively, on three, four, five, \dots , n various media. We will however leave this issue on the side.

The next question pertains to the role played by particular gestuowords by expressing the meaning of a sequence of gestuowords. At the beginning one needs to determine the notion of a standard gestuoword. For this purpose we will take into consideration the established meaning s , as well as its modifications, both positive and negative. According to M. Nowakowska's suggestions: "One may imagine this in the form of a scale, whereon the considered meaning (s) together with its modifications is located" (Nowakowska 1979: 190). For example if s = "cheerfulness," then it will have the following modifications: "despair," "sadness," "moderate cheerfulness," "great cheerfulness," "extreme cheerfulness," etc.

A standard gestuoword, used to express meaning s is a unit meeting two requirements: (1) it does not, to any degree, express negation of meaning s ; (2) amongst the gestuowords meeting the first requirement, it expresses meaning s to the highest degree.³

Having the notion of a standard gestuoword at our disposal, we may introduce several further definitions:

(D29) Gestuoword h expresses meaning s to a higher degree than gestuoword h' , if and only if, the sequence of gestuowords u , wherein at place i there appears gestuoword h , expresses s to a higher degree than the sequence of gestuowords u , where at place i there appears gestuoword h' .

(D30) Gestuoword h expresses meaning s to a lower degree than gestuoword h' , if and only if, the sequence of gestuowords u , wherein at place i there appears gestuoword h , expresses s to a lower degree than the sequence of gestuowords u , where at place i there appears gestuoword h' .

(D31) Gestuoword h expresses meaning s at an analogous level as gestuoword h' , if and only if, the sequence of gestuowords u , wherein at place i there appears gestuoword h , expresses s at an analogous level as the sequence of gestuowords u , where at place i there appears gestuoword h' .

(D32) Gestuoword h sustains meaning s , if and only if, substitution of h by a standard gestuoword in sequence of gestuowords u reduces the degree to which s is expressed by u .

(D33) Gestuoword h generates meaning s , if and only if substitution of h by a standard gestuoword in sequence of gestuowords u excludes the

capability of u to express s .

(D34) Gesturoword h impedes meaning s , if and only if substitution of h by a standard gesturoword in sequence of gesturowords u increases the degree to which s is expressed by u .

(D35) Gesturoword h frustrates meaning s , if and only if substitution of h by a standard gesturoword in sequence of gesturowords u results in an s , which would not appear in other circumstances.

(D36) Gesturoword h is neutral towards meaning s , if and only if substitution of h by a standard gesturoword in sequence of gesturowords u does not change the degree to which s is expressed by u .

(D37) Gesturoword h is immaterial for meaning s , if and only if the preceding condition is met, and the degree to which s is expressed by u is equal to zero.

(D38) Gesturowords h and h' are positively associated by sustaining meaning s , if and only if both h and h' sustain s , however both of them together express s to a higher degree than each of them individually.

(D39) Gesturowords h and h' are positively associated by impeding meaning s , if and only if both h and h' impede s , however both of them together express s to a lower degree than each of them individually.

(D40) Gesturowords h and h' are negatively associated by sustaining meaning s , if and only if both h and h' sustain s , however both of them together express s to a lower degree than each of them individually.

(D41) Gesturowords h and h' are negatively associated by impeding meaning s , if and only if both h and h' impede s , however both of them together express s to a higher degree than each of them individually.

(D42) Gesturoword h catalyses gesturoword h' , if and only if h' does not express s at all, unless accompanied by gesturoword h .⁴

Now is the time to consider the cases when the actor's expression is limited to one or several (but not all) communication media. We are dealing with such situations in certain theatrical or film forms, e.g. in ballet, pantomime or silent movies, which exclude the spoken medium. Therefore, the problem arises of the possibility of expressing certain meanings and differentiating between them only with the use of admissible media of communication.

In order to describe the above state of affairs, we need to distinguish set L' of language of communication L . For a given meaning s we may define two subsets L' : $L^+(s)$ – a set of sequences of gesturowords from L' expressing meaning s to a positive degree and $L^0(s)$ – a set of sequences of gesturowords which do not express s at all:

(D43) $L^+(s) = \{u \in L': f_k(u, s) > 0\}$;

(D44) $L^0(s) = \{u \in L': f_k(u, s) = 0\}$.

Using $L^+(s)$ and $L^0(s)$ we may say that for two given meanings $s, t \in S_k$:

(D45) s is contained in t if and only if

$$L^+(s) \subset L^+(t);$$

(D46) s and t are inseparable if and only if

$$L^+(s) = L^+(t);$$

(D47) s and t are inconsistent (impossible to reconcile) if and only if

$$L^+(s) \subset L^0(t) \text{ or } L^+(t) \subset L^0(s);$$

(D48) s and t are independent (orthogonal) if and only if

$$L^+(s) \cap L^+(t) \neq \emptyset \neq L^+(s) \cap L^0(t)$$

One needs to remember that the above notions are relative with respect to L' ; i.e. the selected set of the media of communication.

The notion of inclusion, inseparability, inconsistency and independence use only a part of the information contained in function $f_k(u, s)$, i.e. they depend on the fact whether the value of this function is equal to zero or not. One could however introduce notions which would be based on entirely different information contained in function $f_k(u, s)$.

For this purpose, let us mark with the symbol $L_a(s)$ a set of all actions expressing meaning s to a degree equal at least to a , i.e.

$$(D49) L_a(s) = \{u \in L': f_f(u, s) \geq a\}.$$

We may then claim that meanings s and t are synonymous, if and only if for each u

$$(D50) f_k(u, s) = f_k(u, t), \text{ i.e. } L_a(s) = L_a(t)$$

and that meaning t a -sustains meaning s , if and only if

$$(D51) (\exists a_0) (\pi a > a_0) L_a(s) \subset L^+(t).$$

Summing up, we need to remind ourselves that the principle objective of this paper was to construct a formal model of acting communication and to provide several detailed definitions. This objective – for obvious reasons – could be achieved only partially. A lack of space does not allow us to discuss succinctly all issues coming to mind. Therefore, the present study should be treated only as a starting point for further thorough deliberations, as a proposal probably requiring many additions and modifications.

FOOTNOTES

¹ The presented definitions may be presented formally in the following manner:

action v sustains meaning s , if and only if

$$f_k(h_i^v, s) > f_k(h_i^\#, s);$$

action v generates meaning s , if and only if

$f_k(h_i^v, s) > f_k(h_i^\#, s) = 0$;
 action v impedes meaning s , if and only if
 $f_k(h_i^v, s) < f_k(h_i^\#, s)$;
 action v frustrates meaning s , if and only if
 $0 = f_k(h_i^v, s) < f_k(h_i^\#, s)$;
 action v is neutral towards meaning s , if and only if
 $f_k(h_i^v, s) = f_k(h_i^\#, s)$;
 action v is immaterial for meaning s , if and only if
 $f_k(h_i^v, s) = 0 = f_k(h_i^\#, s)$.

² By marking gestuorword h with symbol h_{ij}^{uv} , wherein action on media m_i and m_j have been replaced by u and v , and gestuorword h with relevant actions and pauses has been replaced by symbols $h_{ij}^{u\#}$, $h_{ij}^{\#v}$ and $h_{ij}^{\#\#}$, the above definitions may be presented in the following manner:

u and v are positively associated by sustaining meaning s , if and only if

$$f_k(h_{ij}^{\#\#}, s) < \min[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] \text{ and}$$

$$\max[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] < f_k(h_{ij}^{uv}, s);$$

u and v are positively associated by impeding meaning s , if and only if

$$f_k(h_{ij}^{\#\#}, s) > \max[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] \text{ and}$$

$$\min[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] > f_k(h_{ij}^{uv}, s);$$

u and v are negatively associated by sustaining meaning s , if and only if

$$f_k(h_{ij}^{\#\#}, s) < \min[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] \text{ and}$$

$$\min[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] > f_k(h_{ij}^{uv}, s);$$

u and v are negatively associated by impeding meaning s , if and only if

$$f_k(h_{ij}^{\#\#}, s) > \max[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] \text{ and}$$

$$\max[f_k(h_{ij}^{u\#}, s), f_k(h_{ij}^{\#v}, s)] < f_k(h_{ij}^{uv}, s);$$

u catalyses action v , if and only if

$$0 = f_k(h_{ij}^{\#\#}, s) = f_k(h_{ij}^{\#v}, s) = f_k(h_{ij}^{uv}, s).$$

³ Formally h^+ is a standard gestuoroword for meaning s , if and only if:

$$(1) f_k(h^+, -s) = 0;$$

$$(2) f_k(h^+, s) = \max\{f_k(h, s) : f_k(h, -s) = 0\}.$$

⁴ By marking with symbol h^+ a standard gestuoroword, and with symbol u_i^h a sequence of u , wherein gestuoroword h is at place i , the above definitions may be noted in the following manner:

Gestuoroword h expresses meaning s to a higher degree than gestuoroword h' , if and only if

$$f_k(u_i^h, s) > f_k(u_i^{h'}, s)$$

Gestuoroword h expresses meaning s to a lower degree than gestuoroword h' , if and only if

$$f_k(u_i^h, s) < f_k(u_i^{h'}, s)$$

gestuoroword h expresses meaning s at an analogous level as gestuoroword h' , if and only if

$$f_k(u_i^h, s) = f_k(u_i^{h'}, s)$$

gestuoroword h sustains meaning s , if and only if

$$f_k(u_i^h, s) > f_k(u_i^{h^+}, s)$$

gestuoroword h generates meaning s , if and only if

$$f_k(u_i^h, s) > f_k(u_i^{h^+}, s) = 0$$

gestuoroword h impedes meaning s , if and only if

$$f_k(u_i^h, s) < f_k(u_i^{h^+}, s)$$

gestuoroword h frustrates meaning s , if and only if

$$0 = f_k(u_i^h, s) < f_k(u_i^{h^+}, s)$$

gestuoroword h is neutral towards meaning s

$$f_k(u_i^h, s) = f_k(u_i^{h^+}, s)$$

gestuoroword h is immaterial for meaning s , if and only if

$$f_k(u_i^h, s) = 0 = f_k(u_i^{h^+}, s)$$

gestuorowords h and h' are positively associated by sustaining meaning s , if and only if

$$f_k(u_i^{h^+h^+}, s) < \min[f_k(u_i^{hh^+}, s), f_k(u_i^{h^+h'}, s)], \text{ and}$$

$$\max[f_k(u_i^{hh^+}, s), f_k(u_i^{h^+h'}, s)] < f_k(u_i^{hh'}, s).$$

gestuorowords h and h' are positively associated by impeding meaning s , if and only if

$$f_k(u_i^{h^+h^+}, s) > \max[f_k(u_i^{hh^+}, s), f_k(u_i^{h^+h'}, s)], \text{ and}$$

$$\min[f_k(u_i^{hh^+}, s), f_k(u_i^{h^+h'}, s)] > f_k(u_i^{hh'}, s).$$

gesturowords h and h' are negatively associated by sustaining meaning s , if and only if

$$f_k(u_i^{h+h^+}, s) < \min[f_k(u_i^{hh^+}, s), f_k(u_i^{h+h'}, s)], \text{ and}$$

$$\min[f_k(u_i^{hh^+}, s), f_k(u_i^{h+h'}, s)] > f_k(u_i^{hh'}, s).$$

gesturowords h and h' are negatively associated by impeding meaning s , if and only if

$$f_k(u_i^{h+h^+}, s) > \max[f_k(u_i^{hh^+}, s), f_k(u_i^{h+h'}, s)], \text{ and}$$

$$\max[f_k(u_i^{hh^+}, s), f_k(u_i^{h+h'}, s)] < f_k(u_i^{hh'}, s).$$

gesturoword h catalyses gesturoword h' , if and only if

$$0 = f_k(u_i^{h+h^+}, s) = f_k(u_i^{h+h'}, s) < f_k(u_i^{hh'}, s).$$

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Andrzej Łachwa

SEMIOTICS OF ADDRESS PHRASES

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The theory of the automated information search in natural language texts often poses problems, which requires thorough research on this language, conducted partly from such points of view that are not applied in traditional linguistics. An IT specialist conducting this research would mainly notice those characteristics of natural language texts that can be used when building the devices he/she is interested in, in particular search systems which are members of the class of the so called Natural Language Understanding (NLU) systems (cf. Studnicki 1985, Łachwa 1986).

The object of this research, of which a fragment will be presented below, is the language phenomenon of some characteristic referential expressions occurring in certain types of written utterances, namely expressions referring to language utterances by specifying the place of these utterances in a certain system (e.g. a text). A great number of such referential expressions can be observed, for instance, in the corpus of legal texts. Some of them are parts of referential phrases (cf. Studnicki *et al.* 1983, manuscript). We have to stress, however, that only some referential phrases contain the said expressions and that these expressions are sometimes parts of other language expressions.¹ The aim of this study is to describe the said phenomenon in such a way as to provide a sufficient theoretical basis for developing the methods of automated interpretation of referential expressions, i.e. for formulating algorithms indicating those places in a corpus which the interpreted expression refers to. This operation leads to finding the utterance which the given language expression (containing the interpreted referential expression) refers

¹As regards legal texts, this can be validation formulas or referential expressions.

to, i.e. utterances which are in strong semantic relation with the utterance containing this phrase (cf. Łachwa 1986; Studnicki *et al.* manuscript).

A study of the available materials has shown that the referential expressions discussed here are structurally and functionally similar to the expressions called, in the common meaning of this word, addresses, i.e. to the expressions used to define our place of residence, place of work, etc. We believe that the problems related to the structure and use of the latter are much clearer than those related to the expressions that are the proper subject of this article and that addresses are but a particular case of a more general phenomenon, we aim to develop a relevant theory based on the analysis of the meaning of the word *address* and the expressions of which addresses, in their 'common' meaning, are composed. Therefore, this part of the research will be the focus of this article.

The informal structures included in this theory (the theory of the phenomenon of indicating a place in certain physical spaces by using referential expressions referring to the labels of these places and the structures of these spaces) and the terminological apparatus introduced here will be used to analyse certain referential expressions occurring in the corpus of legal texts.

*

* *

1. In common use, in contemporary Polish [as well as in contemporary English – transl. note], *adres* (an address) is usually either an EXPRESSION or an INFORMATION. For example, in the sentence *Can you read this address?* address is an expression, while in the sentence *This address is no longer valid* the meaning of address is a certain information. These are not the only meanings or ways of using the word *address*,² but they are the only ones relevant to us.

²It is claimed (Szymczak 1982; Doroszewski 1958: 29) that the word *adres* in Polish usually means a 'place of residence' or a 'place of work'. This would be the supposed meaning of this word (further referred to as the object meaning) in the sentence *Daj mi znać, gdyby twój adres uległ zmianie* [Let me know, if your address changes]. Consequently, if it really meant the place of residence (or work), the content of this sentence should be similar to *Daj mi znać, gdybyś zmienił miejsce zamieszkania* [Let me know, if your place of residence changes]. But sometimes someone's address may change while the place of residence does not. Thus, the word *adres* does not have an object meaning here, and neither does it in expressions such as *adres miejsca pracy* [work address], *adres zamieszkania* [address of residence], *adres budynku* [address of a building], etc. (otherwise, these expressions would not make sense). Let us now consider sentences such as: *Pod tym adresem nikt nie mieszka* [Nobody lives at this address], *Wysłałem*

2. Every expression that can be called an address expresses an information, also referred to as an address. For example, in the sentence *Read this address and remember it*, we are firstly referring to a certain expression (address-expression) and then to the information contained in it (address-information). It is worth noting that there are also such expressions for which it would be counterintuitive to call them addresses, yet which contain an address-information, for example in utterances such as this one: *Our offices are located* IN MIODOWA NUMBER 7 ON THE GROUND FLOOR AND AT NUMBER 144 IN THE OUTBUILDING. *Please tell these addresses to your colleagues*. If we follow our language intuition, we will not call the capitalised expression an address. We will rather say that it expresses or contains addresses of those offices, i.e. that these are addresses-information. This is what the second sentence of this utterance refers to.

3. The subject of our deliberations will be both those expressions that are called addresses in contemporary Polish [and English] and those which are not called that, even though they in fact express an information-address. Thus, it will be convenient to adopt two terminological conventions: a regulating one and a constructing/structural one. We can agree to use the word *address* in this article solely in the second meaning of the two described in point 1, i.e. for naming an INFORMATION which is called an address in the common Polish language. Furthermore, we shall agree that every REFERENTIAL EXPRESSION OF THE Polish language containing one or more address in the meaning adopted under the previous agreement will be called an ADDRESS PHRASE. An example of an address phrase is the expression capitalised in the utterance analysed in point 2.

4. Address phrases refer to a certain kind of PLACES in physical SPACE.³ By

list na twój adres [*I sent a letter to your address*]. Indeed, these sentences speak of a place of residence, but the word *adres* was used with pronouns *pod* and *na* and we are not able to build sentences, in which the word *adres* would be used without a pronoun, while referring to a place. Thus, the above sentences are phraseologisms, and they are the ones that have the object meaning.

The word *adres* is also used in phrasemes such as *powiedzieć coś pod czyimś adresem* [say something about someone], *zły adres* [wrong address], *pomyłka w adresie* [an error in address], etc. The word is also sometimes used to refer to an official letter containing wishes or congratulations addressed to an eminent person or a high official, usually given to this person in a ceremonial way. Moreover, this word occurs in terms composed of multiple words in official language and in the languages of various scientific disciplines, where its meaning is defined by specific terminological agreements and from where it sometimes spreads to everyday language.

³Some claim that an address is composed of two types of information: one concerning a person or institution, and the second one the location of the former. However, we

physical space we mean such places as a town, district, country and places in the sense of limited parts (fragments, areas) of these spaces. As we explain further in this article (cf. point 7), only some of these places in relevant physical spaces can be the denotata of address phrases, and these are the only ones that are of interest to us. Consequently, the spaces in question will from now on be treated as consisting of a FINITE number of places.

5. An address expressed by an address phrase always specifies the place in several ‘steps’, by gradually ‘reducing the space’. For example, the address can specify, in this order: a country, a town in this country, a street in this town, a house in this street, and an apartment in this house. Thus, first of all the address specifies a place among OTHER PLACES in the same space, and all these places (a finite number of them) form a characteristic structure in this space. A place contains other places, of which each one contains yet other places, etc. In other words, we are talking about a set of places in the collective (mereological) sense, i.e. a set in which the relation of ‘being an element’ is transitive. This relation partly orders the places in the space, and thus gives the space a structure, in the language of graph theory called a TREE. The top of this tree represents the entire space, the remaining nodes represent the places in the space, and the links correspond to the relation of ‘immediate constituency’.⁴ Secondly, an address is composed of some portions of information, which can be ordered from the most general to the most detailed ones. This structure of information represents a certain structure of objects (places) which the information refers to. It concerns in particular a STRING of places of which every subsequent one is contained in the previous one. The string leads to the place which is the final element and at the same time the target indicated by the address, i.e. the denotatum of the address.

6. The places that we are talking about form certain TYPOLOGICAL GROUPS⁵ in physical space. For example, there are groups of towns, groups of streets, groups of districts, etc. The principle of this division is that each two places, one being an element of the other, belong to two different typological groups. On the other hand, the tree structure of space divides all places represented in it into groups which are immediate constituents of the place located ‘higher’ in the structure. To distinguish these groups from the previous

do not consider this interpretation correct.

⁴When talking about elements B , C of a collective set A , we say that B is an immediate constituent of C , if $\forall D \in A (B \in D \in C \rightarrow D = B \vee D = C)$.

⁵A group in common meaning, i.e. a certain number of units forming a single separate whole.

ones, we will call them STRUCTURAL GROUPS. In a given physical space, a typological group can include elements of different structural groups (for example, a typological group of buildings in a town is composed of buildings which are elements of each street and square of the town, i.e. buildings belonging to different structural groups of this space). The opposite is also possible – a structural group may include elements belonging to various typological groups (streets and squares of a district in a town may form a structural group in this town, including elements of two different typological groups – streets and squares).

7. The denotata of address phrases are places such as towns, houses, streets, apartments, villages, etc. These are places meant for people: their places of residence, work, leisure or other activities. However, they are not of the same type as seats in a theatre, bus or train [translator's note: in Polish both types are referred to with the same word – *miejsce*] or a place in a queue, i.e. they are not intended for one person to lie, sit or stand; such places will not be indicated by addresses (we do not call the information written on a ticket to the theatre or train an 'address').⁶ Moreover, the places referred to by addresses are LABELLED in the given space in a special way – just as streets, squares, houses, apartments, housing estates, etc., are labelled.

8. Places are labelled if there is a language sign (simple or complex) attributed to each of them (arbitrarily or based on a custom). The sign will be called a LABEL. Each of the labels carries one or several portions of information, which either specify the membership of the place in a relevant typological group, or distinguish the place in a given structural group. We will call this information, respectively: TYPOLOGICAL and SPECIFIC information. Each label carries no more than one typological information and at least one (usually only one) specific information. For example, the label *Kraków* expresses only specific information, while the label *ulica Dietla* [Dietel Street] expresses both typological and specific information. The first of the aforementioned conditions does not preclude the possibility that the place belongs to several typological groups, as a place can have more than one label, and these labels can carry different typological information.

9. The portions of information discussed above are represented in labels DISJUNCTIVELY, which means that if a label expresses more than one portion of information, it can always be divided into separate parts, of which each carries one portion of information. We will call these parts TYPOLOGICAL COMPONENTS and PROPER COMPONENTS respectively. A typological

⁶It seems, however, that expressions of this kind are one of the examples of the phenomenon for which we are building a theory here.

component is a generic name or an abbreviation of the name. The proper component can be a number, a letter, a combination of a letter and a number, a proper name or – with some generalisation – a part of a proper name, without the generic name contained in it (as the generic name, in this case, is the typological component of the label). For example, if we say that the typological component in the label *Pałac Staszica* is the word *pałac* [palace], and the proper component is the word *Staszica*, then it will be a simplification, as a proper name is not composed of separate words understood as separately denoting signs. More specifically speaking, a label can be attributed⁷ a generic name identical in shape (or sound) to one of the inscriptions (or sounds) being parts of it, if only the place to which the label is attributed is the designatum of this generic name.

10. Place labels in a given space do not have to be unambiguous in this space. They are also usually not unambiguous within their typological group. As it turns out, however, they must be unambiguous within each structural group. For instance, house numbers are usually unambiguous only on a single street, and street names are often unambiguous only in a given town. The reason for this unambiguity is that an address is always perceived as UNAMBIGUOUS INFORMATION in a given space. For example, when someone says that they live in *ulica Krakowska 17*, and we refer the address phrase to the physical space of Kraków City, we expect that it is unambiguous in this space. It seems irrational to assume that there are two streets called *Krakowska* in the same city or two buildings numbered 17 on the same street. There may be some doubt, however, as to what space is concerned in a given case. This should always be clear from the context, circumstances or our knowledge. A phrase such as *ulica Pawia, 2nd floor, apartment no. 7*, in turn, would rather not be called an address, or at least would be deemed incomplete, as it does not identify any specific building in Pawia street. Further in this article, we will focus only on complete and unambiguous addresses in corresponding spaces.

⁷It is not, however, a simple task. For example, the labels *Osiedle Piastów, Osiedle Złotego Wieku, Plac Matejki, Plac Św. Ducha, Plac Wiosny Ludów* can be attributed generic names *osiedle* [housing estate, district] and *plac* [square], while the labels *Zielona Góra, Srebrna Góra* and *Babia Góra, Nowy Targ* and *Długi Targ, Nowa Kamienica* and *Szara Kamienica* cannot be attributed the names *góra, targ, kamienica* [mountain, marketplace, tenement] respectively, as some of the places with these labels are not designata of these names (some are proper names of towns or streets). As it turns out, determining whether a label is complex (carrying more than one elementary portion of information) or not and distinguishing the components of a complex label may be a difficult task.

11. As we have mentioned, an address specifies a place by defining a string of places leading to the place (cf. point 5). In other words, an address specifies a place by indicating several places forming a string, and each of these indications is a portion of information. An address phrase expresses the information by referring to labels. For example, the phrase *w najwyższym budynku stolicy na ostatnim piętrze, na które dochodzą windy samoobsługowe* [in the highest building in the city, on the last floor that can be reached by self-service elevators] is not an address phrase, as opposed to the phrase *w PKiN w Warszawie, na XII piętrze* [in the Palace of Culture and Science in Warsaw, on the 12th floor], although both these phrases indicate the same three-element string of places in the physical space of Poland, each expressing three portions of information. Naturally, we are aware of the fact that it is possible to find or build phrases for which it is not clear whether they are address phrases or not. In this article, however, we focus only on TYPICAL addresses, i.e. phrases that can be considered addresses without any doubt (however, see point 25).

12. The denotata of an address phrase are naturally the places the addresses of which it expresses. But each phrase refers also, at least to some extent, to each of the places forming relevant strings in the related space. For convenience, we will call these places PRE-REFERENTS of an address phrase, while the denotata of this phrase will be called FINAL REFERENTS. According to this terminological agreement, the last pre-referent in a string is the final referent.

13. From the pragmatic point of view, an address or an address phrase refers to two spaces: the one with which the creator associates it and the one with which the recipient associates it. Naturally, these two spaces are usually not identical, but they are always similar enough in the fragments to which the phrase refers that we can deem them undistinguishable. A space related to an address phrase will be further called an ADDRESS SPACE.

14. The structure of an address phrase, in particular the structure of the fragment we are interested in, always results from the shape and content of the address phrase to which it is related. For example, the phrase *Kraków, Pałac Pod Baranami, pokój 7* is related to the space, in which a city, building and numbered apartments have been distinguished, and the phrase *Kraków, Rynek Główny 28, room 7*, having the same final referent, is related to a space, in which a city, a square in this city, numbered buildings in the square and numbered apartments in the building have been distinguished. Sometimes, however (not only to indicate a relevant space, but also to retrace its structure), apart from the address phrase itself, we have to take into

account the circumstances in which it was used: the time, the place, the sender and the recipient (the association of the term *address* with the terms *addressee of an utterance* and *place of utterance*, which suggests itself here, is absolutely incidental).

15. Further in this article, it will still be easier to treat certain parts of an address phrase as elementary information and call them MORPHEMES.⁸ They will include, first of all, conjunctions, punctuation marks and expressions acting as conjunctions in a given situation. We will simply call all elements of this group CONJUNCTIONS. Another group of morphemes are the smallest parts of address phrases corresponding to the components of labels of the places that are pre-referents of these phrases, thus at the same time corresponding to the specific information carried by these labels. The morphemes belonging to this group will be called PROPER morphemes. The third group of morphemes will include the generic names of the aforementioned places. We will call them GENERIC morphemes. We should add that a generic morpheme does need to have a counterpart among the generic components of place labels in a given space. It is enough that such a name acts as a generic name of a relevant place. The correspondence between proper and generic morphemes of labels of places that are pre-referents of these phrases is a PARADIGMATIC RELATIONSHIP in a broad meaning. This relationship includes the relations between various inflectional and conjugational forms of words and various forms of other signs which make up expressions, as well as the relations between an abbreviation and the full form, a number and the corresponding numeral, and sometimes even synonymy or paraphrasing.⁹

16. Apart from morphemes, address phrases may contain other language signs. However, from our perspective, these signs have nothing to do with the interpretation of these phrases, therefore they will not be discussed here.

17. For convenience, we will treat some morphemes or morpheme sequences as ELEMENTARY REFERENTIAL parts of the address phrase. This regards proper morphemes or sequences of morphemes containing proper morphemes and referring to single pre-referents of an address phrase. We will call these parts of address phrases ATOMS. Each atom contains not more than one generic morpheme. We can also assume that one atom can contain no more than two proper morphemes (for it is hard to imagine a label including more than two proper components) . The information expressed by an atom

⁸The term ‘morpheme’ will be used in the technical meaning defined above.

⁹Due to the broad understanding of the paradigmatic relationship, finding a label corresponding to the analysed morpheme or a sequence of morphemes in each case may sometimes prove to be a complicated task (for an automaton).

will be called ATOMIC. Taking into account the aforementioned restrictions, an atomic information will be composed of one, two or three portions of information.

18. An address phrase is a verbalised information about the paths to be taken by the address space tree, related to this phrase in order to reach a given place in this space. If we look at address phrases this way, every phrase of this kind can be considered a description of a step-by-step procedure of moving around in a given space. Every atom of an address phrase can be treated as an instruction defining a single step. Each step can be made only once the previous ones have been completed. As we can see, atomic information is not autonomous – pieces of information are bound to each other in various ways. In particular atomic information can be DIRECTLY DEPENDENT, one from the other, and MUTUALLY INDEPENDENT. Let a_1, a_2, \dots, a_k represent atomic information contained in an address phrase and let A_1, A_2, \dots, A_k represent the corresponding pre-referents of this phrase in the address space related to this phrase.¹⁰ We will say that information a_i is directly dependent on information a_j , if place A_i is spatially contained in place A_j and no A_p among the remaining pre-referents of this phrase fulfils the condition $A_i \not\subseteq A_p \not\subseteq A_j$. We will say that the information $a_{i_1}, a_{i_2}, \dots, a_{i_p}$ selected from a_1, a_2, \dots, a_k is mutually independent, if none of the places $A_{i_1}, A_{i_2}, \dots, A_{i_p}$ is contained in any of these places. For example, in the address phrase *w Krakowie na Kazimierzu przy ul. Szerokiej 7 oraz przy ul. Miodowej 5 i 14* [in Krakow, in Kazimierz district, 7 Szeroka Street and 5 and 14 Miodowa Street], the information expressed by the atom *na Kazimierzu* is directly dependent on the information expressed by the atom *w Krakowie*, and the information expressed by the atom *14* is directly dependent on the information *przy ul. Miodowej*; the information expressed by the atoms *przy ul. Miodowej* and *przy ul. Szerokiej* is mutually independent, etc. The concepts of direct dependency and mutual independence can be extended by including complex information, i.e. portions of information composed of more than one piece of atomic information. For example, in the analysed phrase, the information expressed by the biatomic phrase *przy ul. Szerokiej 7* is directly dependent on the information expressed by the atom *na Kazimierzu* and, at the same time, on the information expressed by the phrase *w Krakowie na Kazimierzu*. The information expressed by the phrases *przy ul. Szerokiej 7* and *przy ul. Miodowej 5 i 14* is, in turn, mutually independent.

19. As we mentioned at the beginning (see points 2 and 3), an address phrase

¹⁰Sometimes two pieces of atomic information a_n, a_i or a greater number of pieces of information correspond to the same pre-referent – see point 23.

can express several addresses, without being composed of address phrases corresponding to these addresses, whereas an address phrase expressing a single address does not necessarily have to be a sequence of atoms corresponding to the sequence of its pre-referents, forming a string in the related address space (like, for example, in the following phrase: *w budynku nr 72 w Krakowie przy ul. Dietla* [*in the building no. 72 in Krakow on the Dietla Street*]). The order of atoms and the use and selection of conjunctions depend, to a large extent, on stylistic considerations decided by the author of an address phrase. It is governed, however, by at least two rules. According to the first rule, sequences of atoms and conjunctions placed next to each other (further called syntagmas), expressing mutually independent information, must be separated by conjunctions. However, conjunctions can also appear between syntagmas expressing directly dependent information. The second rule (more general) is that the structure of an address phrase should ensure unambiguous interpretation of a relevant address space. We can assume that this rule is fulfilled, at least in typical address phrases.

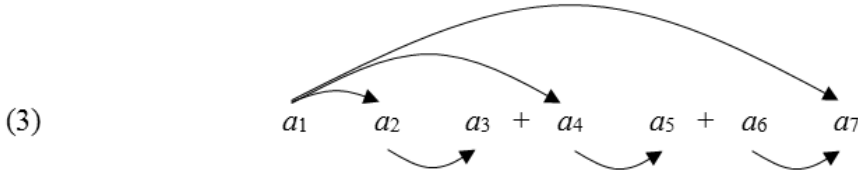
20. An address phrase is an expression composed of atoms and conjunctions, and each atom is a morpheme, a pair or a trio of morphemes, of which at least one is a proper morpheme, and no more than one is generic. The FORMAL STRUCTURE of this phrase can be illustrated by placing conjunctions in angle brackets, proper and generic morphemes in parentheses and atoms in square brackets, leaving other signs in the phrase without special distinction (e.g. pronouns). The marker of the formal structure thus constructed will be called an *f*-MARKER. For example, the formal structure of the following address phrase:

(1) *w Krakowie przy ul Brackiej 2, Brackiej 23 oraz przy placu Matejki 15* [*in Krakow on 2 and 23 Bracka Street and on 15 Matejko Square*] is represented by the following *f*-marker:

(2) $w [(Krakowie)] \text{ przy } [(ul.) (Brackiej)] [(2)] <, > [(Brackiej)] [(23)] <oraz> \text{ przy } [(placu) (Matejki)] [(15)]$

21. The structure of atomic information expressed by an address phrase, called in short a STRUCTURE OF INFORMATION, differs from the formal structure of the phrase. A simple method to show the structure of information is to attribute a marker of this structure, further called the *f*-marker, to the address phrase. We build the marker using a_i , + and \rightarrow . Each a_i represents an atomic information carried by the i -th atom of the given address phrase (i.e. the atom which is in the i -th position in this phrase), each '+' represents a conjunction, and the arrows connect some of the a_i symbols. In particular, if an arrow connects a_i with a_j , then the information represented by the

symbol a_j (toward which the arrow points) is directly dependent on the information represented by a_i ; if, however, arrows point from a_i to $a_{j_1}, a_{j_2}, \dots, a_{j_p}$, then the information represented by symbols $a_{j_1}, a_{j_2}, \dots, a_{j_p}$ is mutually independent. For example, the structure of information of the address phrase (1) is represented by the following i -marker:

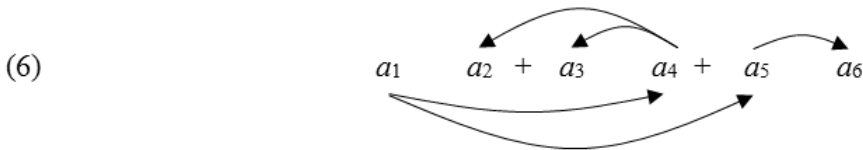


22. Let us now consider an address phrase specifying the same strings of places as (1), but in a slightly different way:

(4) *w Krakowie pod numerami 2 i 23 przy ul. Brackiej, a także przy placu Matejki 15*

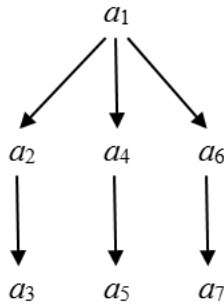
The formal structure and the structure of information of this phrase is shown by the following markers:

(5) *w [(Krakowie)] pod [(numerami) (2) <i> [(23)] przy [(ul.) (Brackiej)] <, a także> przy [(placu) (Matejki)] [(15)]*

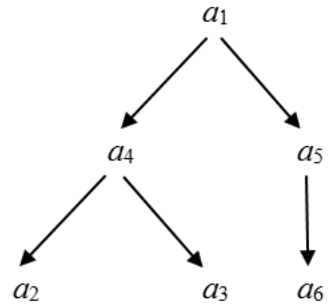


We can see the similarity of the structures of information in the address phrases (1) and (4) by presenting the relevant i -markers, i.e. markers (3) and (6), as trees (the symbols of conjunctions are omitted):

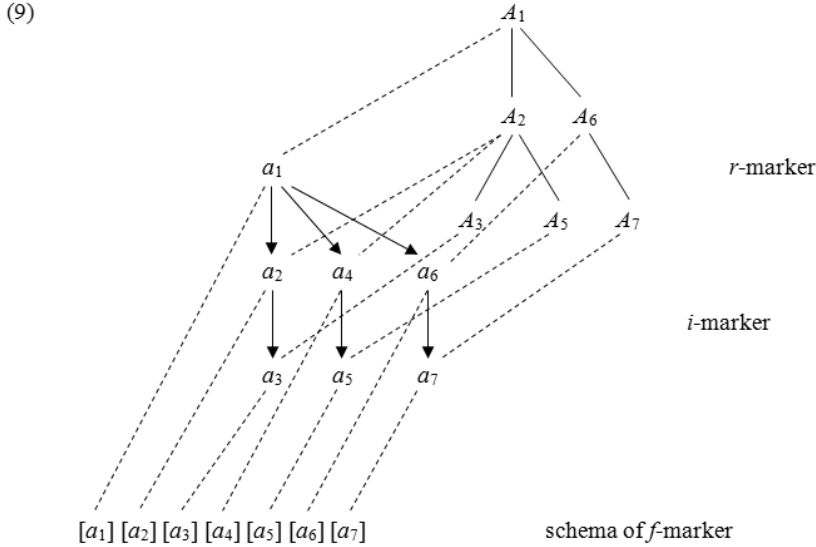
(7)



(8)



23. An address phrase specifies a certain structure of places (pre-referents) in the related space. The structure, here called the **STRUCTURE OF REFERENTS**, can be isomorphic to the structure of information – in fact, it always is, if each pre-referent has exactly one atom corresponding to it in the phrase. On the other hand, these structures may also be merely similar, not isomorphic – it is so, if two or more atoms correspond to some of the pre-referents. The structures of referents of address phrases (1) and (4) are identical; as regards phrase (4), its structure of referents and structure of information are isomorphic, while in phrase (1) the structure of referents differs from the structure of information (for example, it has a different number of elements). Diagram (9) shows the relations between the formal structure, the structure of information and the structure of referents of the address phrase (1). The formal structure of this phrase is represented in the diagram by the image of its *f*-marker, which is a sequence of symbols $[a_i]$ replacing the sequence of atoms (conjunctions and other signs of the phrase will not be shown in the diagram). The structure of referents of phrase (1) is represented by an **r**-MARKER, composed of symbols A_i representing pre-referents corresponding to atomic information a_i (see point 18). If a referent corresponds to several pieces of information $a_{i_1}, a_{i_2}, \dots, a_{i_p}$, then it is marked in the r-marker with the lowest of the indexes i_1, i_2, \dots, i_p . The edges of the r-marker represent the segments of the relation of ‘being an element’ in the given address space (see point 5).



24. So far, we have been neglecting all grammatical differences. But the difference between the singular and plural forms of generic names which are found in address phrases is important to us. An atom in which a generic morpheme is in the singular form¹¹ carries some additional information – namely that the phrase contains atoms which are in mutual independence relation with the former and correspond to the pre-referents of the same type as the former and not containing generic morphemes. Apart from that, we have neglected the differences between conjunctions, although conjunctions may vary in the ‘strength’ of connecting, and these differences may be of importance to us. Let us consider two address phrases:

(10) *w Krakowie przy ul Długiej 2 i przy ul. Miodowej 5 oraz przy ul. Kruczej 7 w Warszawie* [in Krakow on 2 Długa Street and on 5 Miodowa Street as well as on 7 Krucza Street in Warsaw]

(11) *w Krakowie przy ul Długiej 2, a także przy ul. Miodowej 5 i przy ul. Kruczej 7 w Warszawie* [in Krakow on 2 Długa Street as well as on 5 Miodowa

¹¹When we are dealing with an abbreviation of a generic name, it is often impossible to recognise the plural form.

Street and 7 Krucza Street in Warsaw]

If we treated the conjunctions in these phrases as indistinguishable, we would not be sure whether they indicate the *Miodowa* street in Krakow or the one in Warsaw (referring to the structure of the given address space would not help, as there is a street with that label in both cities). The fact that we do not have these doubts proves that the differences between conjunctions must be taken into account in our discussion. However, there is not enough place here to present the details of relevant modifications.

25. Finally, a few words about unusual address phrases. We often encounter expressions which, as our language intuition suggests, contain addresses, although their structure differs from what we have said so far about the structure of address phrases.¹² These are in particular those expressions in which, instead of several atoms with the construction described above, corresponding to the same pre-referent, there is a pronoun in place of a proper morpheme in the second atom or one of the further atoms (e.g. *przy ulicy Pawiej 8, a także przy tejże ulicy pod numerem 15* [*on 8 Pawia Street and on the same street no. 15*]). This case is called pronominal substitution. Proformal substitution also seems possible here.¹³ In our opinion, none of these two types of substitution violate the theoretical constructions proposed above. These substitutes of proper morphemes will be called NON-PROPER MORPHEMES.

*

* *

Let us now pass over the generalisation of our deliberations (the generalisation would involve isolating the introduced terms and constructions from the model on which they are based) and check whether the theoretical approach presented above can be used to interpret expressions which are the main subject of this study, and if yes, then how they can be used. As we have said at the beginning of this article, we are interested in certain referential expressions used in legal texts. Without going into any further detail (which

¹²We can also assume that natural language gives us the possibility to create expressions departing ever further from the proposed type, but which can still be identified as containing addresses, up to those as to which we would have doubts whether they contain addressed or not.

¹³The theory of substitution was introduced and developed by Ronald Harweg (1978).

would be necessary for adjusting the theory to a new model), we propose an analysis of one example.

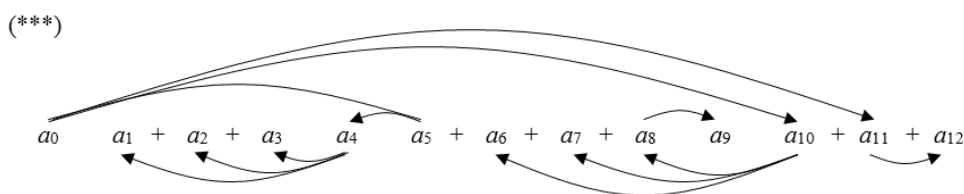
In the first article of a certain law we find a phrase referring to utterances from the corpus of legal texts. The addresses of these utterances are marked by the expression (*), which is a part of this phrase.

(*) *w §§1, 2 i 5 artykułu drugiego niniejszego rozdziału, w art. 7, 9 i art. 15 §7 rozdziału następnego, a także w rozdziale XII, art. 123–125* [in paragraph 1, 2 and 5 of the second article of this chapter, in article 7, 9 and article 15 paragraph 7 of the next chapter, as well as in chapter XII, articles 123–125]

The formal structure of this address phrase (we now apply the terminology of our theory) will be shown by the following *f*-marker:

(**) *w* [(§§)(1)] <,> [(2)] <*i*> [(5)] [(artykułu) (drugiego)] [(niniejszego) (rozdziału)] <,> *w* [(art.) (7)] <,> [(9)] <*i*> [(art.) (15)] [(§)(7)] [(rozdziału) (następnego)] <, a także> *w* [(rozdziale) (XII)] <,> [(art.) (123–125)]

In this marker, there are two non-proper morphemes (*niniejszego*, *następnego*). Instead of information about the proper components of the labels of chapters, these morphemes carry information about the positions of these chapters in relation to the position of the utterance containing the address phrase. Moreover, the last morpheme of the phrase carries information about two proper components of labels of two articles. These articles are the limits of the language unit which is a sequence of articles. The whole unit is, in this case, the pre-referent of the address phrase and the atom containing this ‘unusual’ morpheme defines this unit. The structure of information of the address phrase (*) is represented by the following *i*-marker:



The symbol a_0 means a non-verbalised information about the address space related to phrase (*), i.e. the space in which we will find the referents of this phrase. In this case, the space is the text of the law to which the analysed phrase belongs.

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Kazimierz Trzęsicki
THE SEMANTIC CATEGORY OF TENSE
OPERATORS

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The issue of the semantic category of tense operators is crucial for an account of the role and place of grammatical tenses. The results of tense logic are relevant to linguistics, and its conceptual apparatus opens up possibilities for dealing with many philosophical problems, such as the problems of change, motion, and causality.

I will discuss the three most intuitive accounts of semantic category of tense operators. One of them corresponds to the way tense forms of verbs are constructed in natural languages. The other two remaining theories start from certain ontological assumptions. In each case I will point to semiotic implications and logical consequences.

1. The concept of semantic category

The concept of meaning category was defined by Kazimierz Ajdukiewicz (1978a), who drew on Husserl's (2001) results:

The word or expression A , taken in sense x , and the word or expression B , taken in sense y , belong to the same [meaning] category if and only if there is a sentence (or sentential function) S_A in which A occurs with meaning x , and which has the property that if S_A is transformed into S_B upon replacing A by B (with meaning y), then S_B is also a sentence (or sentential function). (Ajdukiewicz 1978a: 119)

Instead of the term "meaning category," we will employ the expression "syntactic category." The concept is crucial for describing grammaticality

(syntactic consistency) of expressions. The notion introduced by Ajdukiewicz belongs to syntax, since it is defined exclusively by means of syntactic (and, of course, logical) terms, that is, terms describing relations between linguistic expressions.

Every language is created with a specific domain of objects in mind. Each object belongs to a specific category of objects (ontological category).¹ Thus we may ask whether there is a correlation between the syntactic category of expressions and the ontological category of objects to which these expressions refer, i.e. the category of objects which are interpretations of these expressions.

Expressions:

- (1) *Socrates is a philosopher.*
- (2) *Socrates is not a philosopher.*

belong to the same syntactic category – they are sentences. The difference lies in their complexity: (1) is less complex than (2). Likewise, the following expressions fall within the same category:

- (1) *runs*
- (2) *runs quickly*
- (3) *runs slowly*

Expressions (2) and (3) are equally complex and both are more complex than (1).

In the above examples the difference in complexity is reflected by the number of words constituting the expressions. However, it is not always so. Expressions *or* and *if..., then* are of the same category and although the latter is composed of two words, they represent the same level of complexity; in fact, it seems that they should be classified as simple expressions.

Furthermore, sometimes an expression is complex although we use a single word for it. Expressions *is* and *was* belong to the same syntactic category, since we have:

- (1) *Socrates is a philosopher.*
- (2) *Socrates was a philosopher.*

Presumably, since *is* and *was* are different tense forms of the verb *to be*, one of them, if not both, is a compound expression. As indicated by some other tense forms in Polish and other languages, a tense form need not be expressed by means of a modification of the verb – it can be obtained by

¹The concept of ontological category is a problem in its own right. For our purposes, it is sufficient to assume that two objects fall within the same ontological category if they represent the same type of set-theoretic construct (cf. Wójcicki 1974).

adding another expression, that is, by means of a multi-word phrase. For instance, we say:

- (1) *Socrates will sit.*

The above examples show that the term “compound expression” in the sense used here is not a syntactic concept – in contrast to the term “compound expression” understood as “multi-word expression.” It is a semantic notion – its definition will involve semantic terms along with syntactic ones.

A n -ary relation is a set whose elements are ordered sets with precisely n elements. Predicates are expressions which are interpreted as relations. We say that a predicate is n -ary if and only if its interpretation is n -ary. For instance, *runs* is a monadic predicate (at least in some contexts). An ordered singleton with John as its element, symbolically $\langle \text{John} \rangle$, is an element of this relation if and only if it is the case that John runs.

We call the relation which serves as the interpretation of a predicate the range of this predicate. Thus the range of the predicate *runs* contains all and only those ordered singletons whose element A is such that A runs.

Let us return to the issue of complexity. Consider the following expressions:

- (1) *runs*,
(2) *runs quickly*,
(3) *runs slowly*.

We regarded (2) and (3) as more complex than (1). Ranges of (2) and (3) are subsets of the range of (1). Thus both the range of (2) and of (3) stand in a certain set-theoretic relation to the range of (1), namely – inclusion. There is also a set-theoretic relation between the ranges of (2) and (3) – in this case the ranges are mutually exclusive (given that they are not fuzzy or vague). We have assumed that they represent the same level of complexity.

There are also opposite examples. The range of *runs* is contained in the range of *moves* although it seems that they represent the same level of complexity. On the other hand, the ranges of *runs* and *does not run* are mutually exclusive even though *does not run* is more complex than *runs*. The point is that the ranges of *runs quickly*, *runs slowly*, and *does not run*, which we consider to be more complex than *runs*, are functions of the range of *runs*, and this function is somehow indicated by those expressions; in this case – by words *quickly*, *slowly*, and *does not*. Still, it is not the only way of indicating such a function – the task could be performed by the grammatical form of the expression.

In general, we can say that expression A is semantically more complex than expression B if and only if the interpretation of A is a function of the

interpretation of *B*, and, in addition, *A* contains indicators, either lexical or grammatical, of this functional relation. Note that the second condition is indispensable if we do not specify the nature of the relation between *A* and *B*. The requirement secures antisymmetry of the relation of *being a more complex expression*.

We say that an expression *A* is complex (compound) just in case in a given language there is an expression *B* such that *A* is more complex than *B*.

The issue of the correlation between the syntactic category of an expression and the ontological category of the object which serves as the expression's interpretation is particularly interesting in the case of (semantically) compound expressions.

The ontological category of the interpretation of *runs quickly* is the same as the category of the interpretation of *runs*. Both expressions are also of the same syntactic category. The question is whether it must always be the case, that is, whether syntactic categories of expressions are the same whenever the ontological categories of interpretations are the same.

Suppose that the following sentences are synonymous:

- (1) *Socrates is not a philosopher.*
- (2) *It is not the case that Socrates is a philosopher.*

Namely, they are *mutually contradictory with*:

- (3) *Socrates is a philosopher.*

The expression *is not* belongs to the same syntactic category as the second *is* from sentence (2) (and, of course, the *is* from (3)). Yet *not* from (1) is not of the same category as *it is not the case* from (2). Nevertheless, the respective interpretations should be the same since we have assumed that (1) and (2) are synonymous.

We can pose the reverse question, namely, whether the fact that expressions share the syntactic category indicates that their interpretations belong to the same ontological category (this occurs, for instance, in the case of *runs* and *runs quickly*). In the sentences:

- (1) *Socrates is sitting.*
- (2) *Socrates will sit.*

expressions *is sitting* and *will sit* are of the same syntactic category. Yet shouldn't we interpret *will* in the same way as the syntactically different *it will be the case that*? So shouldn't (2) be interpreted just like:

- (3) *It will be the case that Socrates sits?*

Likewise, one may suggest that *was* is a more complex expression with a quite complicated structure. Namely, we might want to interpret both

sentences in the same way:

(4) *Socrates was a philosopher.*

(5) *It was the case that Socrates is a philosopher.*

In summation, it must be concluded that:

(a) a syntactic category of an expression does not sufficiently indicate the ontological category of its interpretation,

(b) the ontological category of the interpretation fails to determine the syntactic category of the corresponding expression.

If we bear in mind that complexity of an expression is not always indicated by the number of words, it becomes clear why the issue of tense operators cannot be framed in purely syntactic terms (in the syntax of natural language). The issue can only be formulated as a question whether in reality, that is in the domain in which the language is interpreted, there are objects of a special kind which could serve as interpretations of tense operators. This question is independent of whether there are any special expressions for those operators or whether there are only grammatical markers, e.g. inflectional ones. The question is also neutral with respect to the syntactic category of expressions.

Let us introduce the notion of semantic category. We will say that expression *A* taken in a sense *x* belongs to the same semantic category as expression *B* taken in sense *y* if and only if the interpretation of *A* is of the same ontological category as the object serving as the interpretation of *B*.

As we have seen, in natural language there is no consistent, one-to-one correspondence between the syntactic and semantic category of a given expression. By contrast, the language of formal logic (and any other formal language) is constructed in such a way as to guarantee one-to-one correspondence. Then two expressions fall within the same syntactic category if and only if they are of the same semantic category. Furthermore, the structure of an expression unambiguously brings out the structure of an object suitable for serving as its interpretation (Curry 1963; Husserl 1931).

In talking about semantic category of tense operators, we will not deal with natural-language expressions but with expressions belonging to a language designed for a logic of such operators. In this designed language, operators will be denoted by expressions (symbols) whose syntactic category will be indicative of semantic category by virtue of a one-to-one correspondence.

Among a variety of syntactic categories three seem especially attractive as candidates for semantic categories of tense operators, namely:

1) the category of a predicate-making (predicate-forming) functor with

a predicate as its argument,

2) the category of a name-making (name-forming) functor with names as arguments,

3) the category of a sentence-making (sentence-forming) functor with a sentence as its argument.

The first category is mainly suggested by the structure of tense forms in natural languages. It may also be favoured by a given ontological theory. I will briefly refer to this understanding of the category of tense operators as “L” (“L” as in “linguistics”).

Accounts (2) and (3) originate in ontological considerations. I will abbreviate the former as A, since its relatively clear exposition can be found in (Ajdukiewicz 1978b). The latter account, abbreviated as P, has been developed and defended by the inventor of tense logic – Arthur N. Prior.

2 Tense operators as predicate-making functors with a predicative argument.

A predicate (P) is an expression with a relation (R) as its interpretation. From a purely syntactic perspective it is an expression such that completing it with an appropriate number of names – depending on its number of arguments – results in a sentence.

In natural languages the role of predicates is played by verbs, which form sentences when coupled with a suitable number of names in appropriate positions determined by grammatical rules of the language.

The ranges of predicates are relations. Relations can themselves be arguments of operations, which can also produce other relations. For instance, the converse relation is defined by a binary relation:

$$\langle x, y \rangle \in \bar{R} \text{ if and only if } \langle y, x \rangle \in R$$

where \bar{R} is a converse of R . The operator of converse relation, “ $\bar{}$ ”, describes, in an intuitively adequate way, the logical relations holding in the natural language between sentences in active voice and sentences in passive voice.

Let $P(a, b)$ be a sentence in active voice – then $P(b, a)$ will be a sentence in passive voice. And if $P(a, b)$ were a sentence in passive voice, $P(b, a)$ would be in active voice. The possibility of iterating the relation “ $\bar{}$ ” follows on from the very nature of the operation of converse relation.

For an arbitrary binary predicate P the following logical correlations hold:

$$(1) \bar{\bar{P}} = P, \text{ that is } - \forall x, y [\bar{\bar{P}}(x, y) \equiv P(x, y)]$$

$$(2) \forall x, y [\bar{P}(x, y) \equiv P(y, x)]$$

Other examples of predicate-making functors with a predicative argument are words *quickly* and *slowly*. Consider the sentences:

- (1) *John is running.*
- (2) *John is running quickly.*
- (3) *John is running slowly.*

The words *quickly* and *slowly* cannot be taken as an argument either for the word *John* or the sentence *John is running* – their argument is *is running*, swiftness is a property of running.² Semantically, functors *quickly* and *slowly* correspond to different operations of taking subrelations of the *running* relation. For any operator Z which denotes such an operation, we have $\forall x[ZP(x) \rightarrow P(x)]$ but not conversely, i.e. it is not the case that $\forall x[P(x) \rightarrow ZP(x)]$.

Are tense operators functors of this type, that is, are they predicate-making functors with a predicative argument? At first sight, the answer is in the affirmative. In natural languages from our cultural background, expressions which produce a tense form of a verb generally belong to the same syntactic category, or at least all of them are predicates. Hence, linguistically, the theory is unproblematic. The only remaining task is to determine the basic form which serves as the argument for corresponding operators of particular tenses.

On the semantic side, tense operators would denote properties of the relation which is the range of the predicate-verb in its basic form. For the English language we could pick the infinitive as the basic form. Thus the word *to run* would denote a relation whose elements are all and only those singletons whose elements can be said to run – in the past, at present, or in the future. Tense operators would denote some properties of these singletons – so that, for instance, the range of the predicate *ran* should encompass all and only those elements of the relation *to run* which have the property indicated by the operator of the past tense.

Note that in order to describe the relation *to run* we needed to appeal to the ranges (extensions) of predicates *ran*, *runs*, and *will run*. In English there is no other way of (intensionally) describing the relation. This, however, cannot serve as a decisive argument against the theory in question since we are invoking an incidental linguistic fact that it is impossible – in keeping with linguistic rules – to talk about the relation denoted by *to run* in a

²John can be said to be quick even if he is running slowly at the moment, or if he is sitting. Yet when we say that John is running quickly, we do not ascribe the property of being quick to John. John need not be quick in order to run quickly (at the moment).

straightforward way, hence the need of circumlocutions. In order to say, in English, that $\langle \text{John} \rangle$ is an element of the range of the predicate *runs*, we say *John runs*. Since John runs, $\langle \text{John} \rangle$ belongs to the range of *to run*, whereas *John to run* is not a well-formed English sentence.

Tense operators denote properties of the elements of a relation. Note that properties of the elements of a relation are distinct from properties of the objects which are elements of those elements. *Quickly* denotes a property of the elements of the relation denoted by the predicate *runs*, yet it does not denote any property of John, who runs quickly – only of the ordered set with John as its only element. We predicate of John that he runs, and we predicate of his running that it is fast. Thus we may say that John has the property of running fast. By analogy, in the case of tense operators we may say that John has the property of running in the past (if it is the case that John ran), of running at present (if John is running now), or the property of running in the future (if John will run).

Apparently, in the case of the passive-voice operator and words such as *quickly*, the only plausible approach is to regard them as predicate-making functors with a predicative argument. Any other account would go against semantic intuitions associated with the function of passive voice or with the meaning of the word *quickly*. It is not so in the case of tense operators, where other solutions are available – it is impossible to select one of them just by invoking basic intuitions about the role of tenses.

Consider *does not* as it is used the sentence:

(1) *John does not run.*

First and foremost, in view of the syntactic category of *does not*, we should consider whether it belongs to the semantic category of predicate-making functors with a predicative argument. Thus *does not* would be regarded as a set-theoretic complement. The range of *does not run* would be the complement of the range of *runs*. Given the requirement that (R) $\langle \text{John} \rangle$, that is, the singleton with John as the element, is either an element of the range of *runs* or of the range of *does not run* (which presupposes John's existence), sentence (1) is equivalent to the sentence:

(2) *It is not the case that John runs.*

(where *it is not the case that* is the functor of the classical negation). If the condition (R) were not met, the sentence:

(3) *John runs.*

and (1) would share the truth value. By contrast, (3) and (2) are contradictory so that they have different truth values.

This shows that in a language in which all names are nonempty the

relation of complementing the range of a predicate is equivalently analyzable as a negation of a sentence, i.e., for each proper name *a*, we have:

$$(not-P)(a) \equiv \sim P(a)$$

where *not-P* is a predicate whose range is the complement of the range of *P*, while “ \sim ” is a symbol of classical negation (i.e. *it is not the case that*).

The issue of tenses, however, is far more complicated than the issue of ‘different’ relations. The sentence *John ran* would be true if and only if John currently has the property that he ran, that is, if John possesses the property of running in the past. Likewise, the present exemplification of the property of running in the future is the necessary and sufficient condition for the truth of the sentence *John will run*. Loosely speaking, the whole history of a given object, that is the set of all true sentences which can be stated about John, would be encoded in properties (features and relations) presently exemplified by the object. We could justify such an account with respect to a situation in which the object exists. A particular problem would be raised by the simultaneous truth of sentences such as *John ran* and *John did not run*. We would be in a particularly difficult position if the objects no longer existed but we would still believe that we are entitled to make true statements about them. We would need to abandon the assumption that these true sentences say something about those objects in a straightforward way. We could say, for instance, that these sentence are really about Earth. Thus the sentence *Socrates was young* should be understood as stating that Earth has a certain property by virtue of which it is true that Socrates was young. The interpretative difficulties become much more serious in the case of expressions with iterated tense operators. For instance, what kind of property would we need to stipulate so as to make the sentence *John had run* true? Yet in our artificial formal language we cannot assume any normative ‘stylistics’ which would preclude an arbitrary iteration of operators.

3 Tense operators as name-making functors with nominal arguments

The examples of name-making operators with nominal arguments include: *agile*, *tall*, and *not* as used in expressions such as *an agile man*, *a tall man*, *not-man*. The first two expressions are names whose ranges are subsets of the range of the name *man*, while the range of the third name is the set-theoretic complement of the range of the name *man*. The words *agile* and *tall* denote certain properties while *not* in the third expression presumably denotes the lack of certain properties (or it denotes negative properties).

The examples suggest that the arguments of operators such as the first two can only be names which are not singular – either with respect to their form, e.g. *the first conqueror of Mount Everest*, or with respect to semantic rules, as in the case of proper names.

The expressions *the first – tall – conqueror of Mount Everest* and *agile Socrates* are not names. Rather, in certain contexts, they are equivalents of sentences, respectively:

The first conqueror of Mount Everest is (was) tall.

Socrates is (was) tall.

It is not so in the case of *not*. The expression:

not-(the first conqueror of Mount Everest)

seems to be as good a name as *not-man*. Yet *not-Socrates* could hardly be considered a name. The name *Socrates* is not a general name, in the sense that it is not predicated in virtue of some properties of the referent.

We may ask what names would be acceptable in the language if the tense operators were name-making functors with nominal arguments. For instance, how should we understand the name *Socrates* in the sentence *Socrates is young*?

In the article *Change and Contradiction* Ajdukiewicz rejects arguments for the claim that change entails contradiction. According to one of those arguments, a changing object both is and is not such and such at the same time. Ajdukiewicz (1978b: 207–208) states that:

Every object in time, hence also every object undergoing changes, has not only spatial but also temporal dimensions. There are many predicates which we can predicate of some of its temporal parts only but not of others [...] These sentences attribute a property to some temporal segments of an object known as Socrates and deny it to some other temporal segments of the same object. But they do not refer to the same object, since each refers to a different temporal segment of Socrates.

Ajdukiewicz, therefore, implicitly supports the account of tense operators according to which they are name-making functors with nominal arguments. He regards the name *Socrates* as a common name with many referents (as many as Socrates' temporal parts).³ The past-tense operator forms, together

³In analyzing the issue of continuity of change, Ajdukiewicz observes that: “the principle of continuity is not an a priori truth; it is at best an inductive generalization from experience. Nor is it regarded as universally valid in contemporary science. For contemporary science acknowledges the existence of ‘quantum’ changes, i.e. non-continuous changes in the processes of emission and absorption of energy.” In the case of the quantum time the name *Socrates* would have a finite number of referents, while

with the nominal argument *Socrates*, a name of all and only those temporal parts of *Socrates* which are in the past with respect to the instant at which the sentence is accepted. The present-tense operator forms, together with the name *Socrates*, a name of temporal parts (a temporal part?) of *Socrates* which share(s) the temporal coordinate with the fact of accepting the present-tense sentence. The future-tense operator forms, together with *Socrates*, a name of future temporal parts.

In a four-dimensional, spatiotemporal world objects exist in the same way not only in their spatial dimension but also in their temporal one. What presents itself to us as an object is only a temporal stage of some object, its spatiotemporal part. None of those stages differ as to the mode of existence; being past, present, future are only features of sections of objects, and relative at that, dependent on the temporal position of the perceiving subject. Just as in the case of spatial dimensions we grasp something as the beginning and something else as the end, something as the bottom and something else as the top depending on its spatial position relative to us, so we can grasp something (although not sensually) as past, present, and future. The mode of existence of particular spatial sections is the same; the same is true of the temporal sections.

It is plausible, therefore, to use the name *Socrates* as an individual and singular name. Yet it will be for a use in which it refers to the whole spatiotemporal entity, all temporal parts of *Socrates* taken together.

Let us introduce symbols for the operators. Let p be the operator of the past tense, n – the present-tense operator, and f – the future-tense operator. Let A be a name (a common name whose referents are temporal sections). The expression pA will be a name referring to all and only those referents of A which are in the past with respect to the time of employing A in a sentence in the form of the past tense. The expression nA is a name of the referents of A which are simultaneous with the time of accepting the present-tense sentence in which A occurs. Whether nA is empty or has at least one referent depends on the object itself. Whether it has one or more referents depends on the theory of temporal parts and on the properties of time, e.g. on whether the present instant has a temporal extension or is just a point. The name fA denotes all and only those referents of A which are located in the future with respect to the use of A in the future-tense

in the case of dense time the set of referents would be countably infinite and in the case of continuous time – uncountable. Let us add that a name is common if and only if it potentially has more than one referent, that is to say, the meaning of a common name does not rule out being applicable to more than one object.

sentence.

Operators p , n , and f can be iterated. Accordingly, the range of ppA is a subset of the range of pA . Since the range of pA is in turn a subset of A , also the range of ppA is a subset of the range of A . The particular range depends on the properties of time. The name ppA would designate every referent x of A such that there is a referent of pA between x and a referent of A . Of course, the *between* relation is determined by the relation of succession holding between instants. The way of interpreting an expression which contains different operators requires making suitable decisions. Thus pfA may be interpreted in two ways: first, the result of performing the operation p on the set of referents of fA might be the set of all and only those elements of the range of fA for which there is some successive element in the range of fA – let us label this as the resulting set B ; second, the outcome might be the set of elements of the range of A with a successive element in the range of fA – let us label this set C . The following set-theoretical relation holds between B and C : $C = B \cup nA \cup pA$.

Both readings of pfA are supported by semantic intuitions. As an example, consider the sentence *It will be the case that John was in Cracow*. One might think that the sufficient and necessary condition of this sentence being true is that at a certain point in the future (with respect to the time of accepting the sentence) it should be true that John was in Cracow. Alternatively, one might insist that the sufficient and necessary condition of this sentence coming out true is that for a certain instant t_1 which is in the future with respect to the moment t_0 of accepting the sentence it should be the case that between t_1 and t_0 there is an instant t_2 at which it is the case that John is in Cracow. By the same token, there are two possible readings of fpA .⁴

⁴Natural-language sentences should be used in such a way as to guarantee that they possess no more than one meaning. Hence the context of utterance will suggest the correct way of interpreting – in accordance with semantic rules – a sentence with iterated tense operators (if it is a natural-language sentence compatible with grammatical rules). A formal theory of grammatical tenses is not governed by any ‘stylistics’, so that we are in a position to put together formulas with any combination of iterated tense operators. The fact that some of those sentences are unacceptable in the natural language can be explained by pointing out that in this language we take into account the meanings of those operators and form ‘economical’ statements. For example, if we grant that transitivity and density of time secures the truth of the equivalence $fA = ffA$, then it becomes clear why the natural language lacks statements with ff -operators. In a language with sufficiently rich meaning of p and f the number of distinct ‘grammatical tenses’ is reduced. Cf. e.g. Prior 1967: 45–48.

Various authors discuss a variety of definitions of tense operators and their iterations

Other problems are brought about by the interpretation of expressions nfA , fnA , npA , and pnA . In each case we should endorse the following identities: $nfA = fA$, $npA = pA$, $nnA = nA$. Note that we translate the sentence *Socrates was young* into:

(1) $p(\textit{Socrates})$ is young.

where *is* is a present-tense form, so it could be rendered as:

(2) $np(\textit{Socrates})$ is young.

Since sentences (1) and (2) should be considered synonymous, we should also admit that $np(\textit{Socrates}) = p(\textit{Socrates})$.

In (1) and (2) the tense operators have operated on one name. Yet it is not always so. For instance, in the sentence *John talked to Peter*, the arguments of p are *John* and *Peter*. Thus we understand this sentence as: $p(\textit{John}) \textit{ talks to } p(\textit{Peter})$.

Another difficulty for the theory in question is the issue of a natural reading of operators p , n , and f , namely, a reading – carried out by means of natural-language expressions – which would preserve the basic semantic intuitions and would provide counterparts belonging to the same syntactic category, that is – name-making functors with a nominal argument. Constructions such as *a former landowner* fail to meet these requirements. Someone is a former landowner just in case this person used to be – but is no longer – a landowner. In saying that someone was a landowner we do not specify whether this person has ceased to be a landowner. Still, the fact that our natural language lacks a natural way of reading p , n , and f supports the theory in question, or at least it is not at odds with it. For if there was such a natural reading – if we could read out our operators in accordance with grammatical, stylistic, and semantic rules – we would be obliged to explain why we fail to do this, that is, why we use distinct forms of a verb instead of distinct forms of the noun which serves as the name of an object described by a given sentence.⁵

As we have noted above, the name *Socrates* can be used in such a way as to denote a spatiotemporal entity as a certain whole, namely Socrates not as a set of temporal stages but as an indivisible object. Understandably, in

that would secure a formally correct and intuitively adequate description of tenses in the natural language. The first to take up this task was Reichenbach (1947). An interesting solution to the problem of iteration was proposed by Gabbay (1966). He introduced the notion of multidimensional tenses with parameters (1966: 139–141). For an overview of various proposals concerning the meaning of tense operators as sentence-making functors with sentential arguments, cf. Benthem 1983: 127–135.

⁵In some language, e.g. in Inuktitut, tense operators are ‘encoded’ by means of adjectives, that is, by a category of name-making expressions with nominal arguments.

sentences containing such a name, the use of different tense forms does not play, and cannot play, a role of ‘encoding’ the use of tense operators p , n , and f . For grammatical reasons, verbs need to be given a specific tense form which can be prompted, e.g., by stylistic considerations. In the sentences *Socrates was Greek*, *Socrates lived for seventy years*, we say nothing about Socrates’ temporal parts – instead we are talking about Socrates *qua* a spatiotemporal whole. Hence, it would be wise to speak of an atemporal sense of *is* and *was*. Note that the latter sentence can be translated – though not in a completely felicitous way – into a sentence with a verb in the present tense: *The duration of Socrates’ life equals seventy years*. The sentence has a structure similar to the sentence *The length of the table is two metres*.

In order to reject one of the arguments that lead to the conclusion that change involves contradiction, Ajdukiewicz implicitly assumed that tense operators are name-making operators with nominal arguments. One might ask whether this argument can only be dismissed in such a framework. If it were so, then that alone would provide a serious reason for endorsing this understanding of tense operators. However, it can be shown that the argument criticised by Ajdukiewicz does not hold water even if we assume the theory discussed in section 2. To see that, one would note that having the property of past youth is compatible with having the property of being currently old. Likewise, change does not lead to contradiction if tense operators are analyzed as sentence-making functors with a sentential argument, which will be shown in the next section.

Let us consider another argument in favour of the theory discussed here. It seems that only this theory entitles us to regard the sentence *The white was black* (*Album fuit nigrum*) as a sentence which is not false in virtue of the meanings of the expressions used (analytically). The tense operator, with the name *the white* as the argument, forms a name of past temporal sections, (at least) one of which is black. Yet by uttering the sentence *The white was black*, we state that what is now white was once black, in other words, that a certain temporal part of the thing whose present temporal part is white is black. So *the white* does not denote temporal parts of the object A , but it only denotes a particular temporal part of A , namely, the current one (simultaneous with the act of uttering *white*) and serves as a specification of that object. Thereby the sentence *The white was black* is equivalent to nA is white and pA is black. Since the sentences nA is white and pA is not white are not mutually exclusive, the conjunction of nA is white and pA is black is not analytically false.⁶

⁶This classical example is discussed by Mates (1960) and Prior (1962). The prob-

4 Tense operators as sentence-making functors with a sentential argument

The theory of tense operators as predicate-making functors with a predicative argument – the L-view – assumes, as a necessary condition of L’s validity, a uniform ontological status of all relations (which were satisfied, are satisfied, and will be satisfied). In interpreting the operators as name-making functors with a nominal argument – the A-view – one assumes a uniform ontological status of all temporal sections of objects (i.e. of spatiotemporal wholes). The semantic counterparts of true sentences are facts. Thus in regarding tense operators as sentence-making functors with a sentential argument we accept a uniform status of all facts. This assumption seems to produce less difficulties than the previous ones, both ontologically and linguistically.

According to the L-view, elements of relations have properties by virtue of which it is possible to state true, variously tensed sentences about objects (which are arguments of those relations, that is, elements of their fields). On the A-view, temporal parts of an object were divided into past, present, and future. Once it is facts that serve as the basis for stating true sentences in various tenses, the properties of being past, present, and future will belong to facts.

In the framework of L- and A-views, we distinguished a separate present-tense operator. On the L-view, this operator denotes a property of the elements of the relation which were currently satisfied, and on the A-view it denoted a property of the temporal sections which were simultaneous with the use of the relevant name. On the P-view (the theory now under discussion), it is not so – the n -operator is redundant. Note that the sentence which is the argument of the operator need not be formulated in any particular tense. Let A be in the present tense. Clearly, $A \equiv nA$, which holds neither for p nor for f , that is to say, A is not logically equivalent either to pA or to fA . The following equivalences hold: (1) $pA \equiv pnA$, (2) $fA \equiv fnA$. In logic we make use of sentential variables so as to be able to substitute them with arbitrary sentences. If npA were not equivalent to pA , and nfA were not equivalent to fA , then even if pA is equivalent to pnA and fA to fnA , the equivalences $ppA \equiv pnpA$ and $ffA \equiv fnfA$ (obtained from (1) and (2) by substituting pA and fA for A) would not hold.

lem was known in the Middle Ages and we encounter it e.g. in Walter Burley’s *On the Purity of the Art of Logic* (1955: 48–49, 2000: 133). For the analysis of a similar sentence *Senex fuit puer*, cf. Prior 1967: 142–145. The problem is also associated with the issue of translatability of *de re* modality into *de dicto* modality.

These equivalences are substantiated by linguistic intuitions. Sentences *It is the case that it was the case that A*, *It is the case that it will be the case that A* state precisely the same thing as sentences *It was the case that A* and *It will be the case that A*, respectively. It is impossible that (i) it is now true that *A* was the case but (ii) it is not true that *A* was the case. Likewise, given that it is now true that *A* will be the case, it is impossible that it is not true that *A* will be the case. If truth belongs to a sentence at all, then it does so in the present. Furthermore, given that it is true that *A* was the case, it is impossible that it is not true that it is now the case that *A* was the case. Likewise, if it is true that *A* will be the case, then it cannot be false that it is now the case that *A* will be the case.

The operators *p* and *f* will be read as *it was the case that* and *it will be the case that*. It is a natural way of reading them – in the sense of “natural” which was used in the context of the A-view. The expressions *it was the case* and *it will be the case* are sentence-making functors with sentential arguments, so they are of the same category as *p* and *f* in the P-theory. The semantic intuitions which we attach to *it was the case* and *it will be the case* sufficiently agree with the meanings of *p* and *f*. Even so, we should not equate *p* and *f* with those expressions. In describing the A-view we have pointed out that the lack of expressions which would enable a natural reading of tense operators may support the view. The fact that we have found such a natural reading in the case of the P-view raises a familiar problem: why do we formulate tensed sentences in terms of predicate modifiers if the ordinary language equips us with a suitable way of ‘reading’ tense operators *p* and *f* by means of expressions of the same syntactic category?

There is also a problem of elimination of *p* and *f*: it is suggested that sentences containing those operators can be translated into supposedly equivalent sentences without *p* and *f*. For instance, *pA* is construed as:

In an instant preceding the time of uttering *pA* it is true that *A*.

The expression *ppA* is meaningful – its truth value should be independent of the fact of uttering *pA*. Yet for the above paraphrase we would obtain:

In an instant preceding the time of uttering *ppA* it is true that *pA*.

Eventually, it would lead to the following truth condition for *ppA*:

In an instant preceding the time of uttering *ppA* it is true that (in an instant preceding the time of uttering *pA* it is true that *A*).

As a result, the question about the truth value of *ppA* would be impossible unless, before the utterance of *ppA*, *pA* had been uttered. If we understood the present-tense operator in a similar manner, the truth of *A* would require that we first utter *nA*, *nnA*, etc. (Rescher, Ugruhart 1971: 26–29; Prior 1967:

11–12)

We assume that in order for pA to be true it is necessary that at some time preceding the moment of accepting pA it is true that A . The sentence A is in turn true if at the time of its acceptance it is true that A . Still, when I am uttering pA , by no means do I state that before the act of uttering pA it was true that A . Still, it is a truth condition of my statement that before my utterance it was the case that A . Similarly, when I utter A , I do not thereby state that at the moment of the utterance A is true. It is just a truth condition of my statement that at the time at which I am uttering A , A is actually the case. In other words, when I utter pA I do not say anything about pA , and when I utter A , I do not say anything about A . We need to distinguish the content of the statement from its truth conditions.

Let us now consider how the present theory deals with natural-language sentences. We can distinguish three classes of sentences:

- a) sentences which do not offer any date or a pseudo-date at which the fact which makes a sentence true occurs,
- b) sentences offering some kind of a time measure (a pseudo-date) which indicates the distance between the moment of utterance and the fact which makes the sentence true,
- c) sentences containing a date specifying the time at which the relevant fact occurs.

Let us emphasize that a pseudo-date specifies the moment at which the relevant fact occurs with respect to the moment of utterance involving the pseudo-date. By contrast, a date points to the position in time without any reference to the time of utterance.

The examples of this kind (a) are:

- (1) *Socrates was young.*
- (2) *Two plus two equals four, Socrates is sitting.*
- (3) *It will be Sunday.*

These sentences are interpreted as:

- (1') $p(\textit{Socrates is young})$
- (2') $\textit{Two plus two equals four, Socrates is sitting.}$
- (3') $f(\textit{it is Sunday}).$

The sentence *Two plus two equals four* is usually regarded as atemporal, that is, it refers to a timeless domain containing facts which do not take place in time. The point is not that such a domain contains facts which are *always* the case, which hold at every point in time, but that referring such facts to time is misguided. In such domain sentences such as *Two plus two equalled four* and *Two plus two will equal four* would be meaningless. Asking

about their truth value would be pointless. Nonetheless, we can point to contexts in which we employ such sentences so as to express true, or even false, propositions – for instance when describing the process of counting. The sentence *Two plus two equalled four* was false in such a context if we had made a mistake in the calculation, e.g. if we obtained five by adding two to two.

Sentence (3) is not a (b)-type sentence. *Sunday* is not a pseudo-date in the present sense. The examples of (b) are:

- (1) *Yesterday it was Sunday.*
- (2) *It will be Monday in a week.*
- (3) *I will be reading tomorrow.*

These sentences cannot be interpreted as:

- (1') *p(yesterday it is Sunday)*
- (2') *f(it is Monday in a week)*
- (3') *f(I am reading tomorrow)*

In the case of (1') it is possible to question the correctness of translation: we do not say *Yesterday is Sunday*. However, by analogy to (2') and (3') we might extend the stylistic convention so as to make the expression stylistically acceptable. On the semantic side, and even more so on the syntactic level, its correctness is unquestionable.

Still, (1), (2), and (3) are not equivalent to (1'), (2'), and (3'). They are equivalent to the *arguments* of tense operators in (1'), (2'), and (3'), that is, to the following sentences:

- (1'') *Yesterday it is Sunday.*
- (2'') *It is Monday in a week.*
- (3'') *Tomorrow I am reading.*

We can assume that in (b)-sentences the use of a tense form of a verb other than the present tense is motivated purely by stylistic reasons. Such a use does not 'encode' tense operators *p* and *f*, so that the relevant sentences are only seemingly more complex (in the sense of complexity specified above) than the corresponding sentences framed in the present tense. We could speak of an apparent occurrence of *p* and *f*.

The following sentences illustrate the type (c):

- (1) *King John Sobieski won the battle of Vienna in 1683.*
- (2) *King John Sobieski wins the battle of Vienna in 1683.*
- (3) *King John Sobieski will win the battle of Vienna in 1683.*

It seems that not only are we dealing here with the apparent use of *p* and *f*, like in the (b)-type sentences, but also with the apparent occurrence of the present-tense operator. The expression:

It is now the case that in 1683 king John Sobieski wins the battle of Vienna.

is neither true or false, just as the expression

It is now the case that $2+2=4$.

is meaningless – it is just a result of mixing up distinct languages. On this view, verbs in (c)-type sentences are used in a different sense than in (a)-type sentences.

However, analyzing (1) and (3) as:

(1') *p(king John Sobieski wins the battle of Vienna in 1683)*

(3') *f(king John Sobieski wins the battle of Vienna in 1683)*

seems incorrect. Admittedly, if we were guided exclusively by semantic intuitions which we attach to expressions *it was the case that* and *it will be the case that*, we might accept the respective equivalences. In any case, I believe that (c)-type sentences involve a real use of tense operators. The realm to which such sentences refer is not an atemporal domain – in contrast to the mathematical domain, it extends in time. Facts which constitute this realm are temporally defined, so the sentences referring to it involve a real occurrence of a tense operator, or at least a real occurrence of the present-tense operator. The sentence:

It is now the case that king John Sobieski wins the battle of Vienna in 1683.

is not equivalent to sentence (2). The expression *it is the case that* in one of its senses points to a certain transitional character, which is absent from (2). Still, we must emphasize that the expression *it is now the case* is only a way of reading the present-tense operator and is not synonymous with it. *It is now the case* agrees with the meaning of the present-tense operator only in what it positively states.

In my view, sentences (1) and (3) should be analyzed as compound sentences:

(1') *It was the year 1683, and king John Sobieski wins the battle of Vienna in 1683.*

(3') *It will be the year 1683, and king John Sobieski wins the battle of Vienna in 1683.*

Sentence (2) is more problematic. By analogy to (1) and (2), it might be understood as:

(2') *It is year 1683 now and king John Sobieski wins the battle of Vienna in 1683.*

But of course, now, when I am writing this paper, sentence (2) is true while (2') is false. So (2) cannot be analyzed as (2').

In (c)-type sentences, like in (b)-type sentences, the only real occurrence is of the present-tense operator. Yet, while in (b)-type sentences the use of a form different from the present-tense form was prompted by stylistic reasons, the use of such operators in (c)-type sentences is not merely stylistic in character: it conveys information about the position of the date with respect to the temporal position of the speaker. (The latter position need not be real – it could be a fictional position taken by the storyteller.) Thus the use of the future-tense or past-tense forms is a means of stating a conjunction of two sentences. Note that in order to mark the simultaneity of the utterance with the fact to which this utterance refers, the speaker must use specific lexical tools instead of grammatical ones, i.e. instead of the tense forms (which are employed in other cases). Thus, to mark that the position of the speaker is simultaneous with the battle of Vienna, we could say:

It is the year 1683. King John Sobieski wins the battle of Vienna.

Sentences:

(1) *It was the year 1683.*

(2) *It is the year 1683.*

(3) *It will be the year 1683.*

are (a)-type sentences and we interpret them as:

(1) $p(it\ is\ 1683)$

(2) $f(it\ is\ 1683)$

Above, we have distinguished a temporal and an atemporal use of a verb. The particular use of a verb should depend on the domain in which we interpret the language. Moreover, within temporal uses, one might be tempted to differentiate various temporal meanings of verbs, especially of the verb *to be* (Rescher, Urguhart 1957: 23–25). Thus, depending on the context, the word *is* would mark the amount of time in which the fact described by the sentence is true. For instance, in the sentence:

(1) *Copper is a conductor.*

we would deal with *is* in the omnitemporal sense, and in the sentence:

(2) *Earth is a planet of the Sun.*

with *is* in the transtemporal sense. Accordingly, (1) would be equivalent to:

(3) *It is always the case that copper is a conductor.*

Sentence (1) is the argument of *it is always the case* in (3). If the meaning of *is* depended on the context of use, then sentence (1), as the argument, would be equivalent to the sentence (3), and by the same token, (3) would amount to:

(4) *It is always the case that that it is always the case that copper is a conductor.*

Yet (3) and (4) need not be logically equivalent, i.e. equivalent by virtue of the meanings of the expression used in them. The meaning of *it is always the case* depends, for instance, on the properties of time. Nevertheless, this does not rule out the possibility of using (1) to express the proposition which is the meaning of (3). As we have shown, however, this possibility does not stem from the ambiguity of *to be*. The true reason for understanding (1) as (3) is the belief shared by the language users that substances have permanent properties insofar as electrical conduction is concerned. The equivalence of (1) and (3) is based on this enthymematic premise.

So far we have set aside the issue of the meaning of the term “sentence.” Expressions used as examples of sentences were undoubtedly sentences in the grammatical sense, that is, they belonged to the corresponding syntactic category. One may doubt, however, whether they are a sentence in the logical sense. We should pose this question with respect to the following expressions:

- (1) *Socrates is young.*
- (2) *It is the year 1683.*
- (3) *Today is Wednesday.*

It has been claimed that these expressions are only sentential schemata (sentential functions).⁷ On this view, a sentence (in the logical sense) has a constant truth value which is always the same, that is, whenever the sentence is uttered. An example of such a sentence would be:

- (4) *King John Sobieski wins the battle of Vienna in 1683.*

By contrast, expressions (1)–(3) change their truth value depending on the time of utterance, so that they are not sentences in the logical sense.

Let us observe that even in the case of (4) it is far from obvious that we can say that (4) is a sentence in the logical sense – whether it always had the same truth value. For instance, was it really true in the year 1000 that Sobieski would win the battle in 1683? Even assuming the classical definition of truth, it is implausible – after all, in 1000 there might have been no reality corresponding to (4). Perhaps it was not already fixed that Sobieski would actually win.

The difference between (4), on the one hand, and (1)–(3) on the other, might lie elsewhere. If there is a time at which an expression such as (4) is true, then it will never be false, and vice versa, if it is false at some point, it

⁷Some authors insist that sentences like *Socrates is young* are functions of a temporal variable. Such a view forces us to assign a purely stylistic value to tenses. As for the history of this topic, cf. Prior 1957: 104–122, 1967: 15–17, and McArthur 1976: 1–7.

will never acquire the opposite truth value. It is not so in the case of (1)–(3). When I am uttering (3) now, I express a false proposition, since today it is Monday. Yet if I utter (3) in two days, I will express a true proposition.

Yet expressions (1)–(3) are not sentential functions since functions must contain a variable, and variables can never be used to state a sentence which is true or false.

The above difficulties can be resolved by a clear distinction between a sentence and a proposition. By a proposition we will understand the meaning of a sentence. A sentence considered as a physical object – a written mark or a vocal sound – would have a determinate position in time and space. A well-formed sentence should have precisely one meaning at the moment of utterance – so that its use would express precisely one proposition. It would not rule out using this sentence (as a type) to express a different proposition in different circumstances. Hence it is clear that the truth value should be assigned to propositions and to uses of a sentence expressing a given proposition. The difference between (4) and (1)–(3) is that whenever (4) is used it will express the same proposition, thus (4) is potentially univocal. By contrast, (1)–(3) are potentially ambiguous or multivocal, that is, they have different meanings depending on the circumstances of use.

As a final point, let us consider relations between the accounts of tense operators discussed so far.

In the case of the expressions *not* and *it is not the case*, we have specified the conditions under which a sentence containing *not* can be equivalently translated into a sentence containing *it is not the case*. Or, to put it more technically, we have identified the sentence which must be conjunctively attached to a sentence *A*, which contains *not*, in order that *A* turns out to be the equivalent to a sentence obtained from *A* by replacing *not* with *it is not the case that*. However, when we speak of relations between the theories of tense operators we have a different kind of relation in mind. In the case of *not* and *it is not the case*, we are talking about a correlation between interpretations of two distinct expressions belonging to a language interpreted in the same way (i.e. to one and the same language). In the case of different theories of tense operators we deal with three separate languages, which precludes that kind of correlation. These three languages share a point of reference – the natural language. They are supposed to provide its adequate reconstruction in language in which there is a one-to-one correlation between syntactic and semantic categories.

Like above, I will designate tenses with *p*, *n*, and *f*. Their category will be determined by the context of use. Depending on the arguments they take

– whether it is a predicate, a name, or a sentence – they will be classified as a predicate-making functor with a predicative argument, a name-making predicate with a nominal argument, or a sentence-making functor with a sentential argument.

Consider the sentence *John is running*. According to the three theories, the sentence will be interpreted as:

- (1) *John* $n(\textit{to run})$ – the L-view
- (2) $n(\textit{John})$ *is running* – the A-view
- (3) $n(\textit{John is running})$ – the P-view

Given that each object has no more than one present spatiotemporal section, what we are talking about in each case is denoted by a singular name (on the A-view by nA). In order to regard (1) as singular we must additionally assume that there is precisely one property in virtue of which John can be said to be running.

By a simple sentence in the logical sense we understand a sentence which contains no expressions serving as sentence-making functors with at least two sentential arguments. Such sentences are, e.g., *John is running* and *It is not the case that John is running*, but not *John is running or is walking*. Simple sentences also include quantified expressions such as *All men are mortal*, *Someone has solved the problem*. A compound sentence in the logical sense is a sentence which is not simple in the logical sense.

The division into singular sentences (individual facts) and universal sentences (universal facts) is a subdivision within the category of simple sentences (cf. Prior 1968: 12–14). A universal sentence is a simple sentence whose truth value is determined by truth values of more than one sentence; in other words, its interpretation is a function of truth values of a certain non-singular class of sentences. An example of a universal sentence is *All men are mortal* – its truth value is determined by truth values of sentences ascribing mortality to particular men. Likewise, *Someone has solved the problem* is also a universal sentence: its truth value is a function of sentences predicating of particular people that they have solved the problem. By a singular sentence we understand a simple sentence which is not universal. The examples of singular propositions include: *Socrates is sitting*, *John is not running*, *Białystok is a town*.

Given these terminological stipulations, consider the following sentence in the past tense – *John was running*. In particular theories we interpret it as:

- (1) *John* $p(\textit{to run})$
- (2) $p(\textit{John})$ *is running*

(3) $p(\textit{John is running})$

If we assume that John exemplifies different properties depending on the time at which John is running – a different property is ascribed to him with respect to the run on 1 May 1983 and a different one with respect to the run on 2 May 1983 – then sentence (1) is not a singular sentence (although the role of the subject term is played by the individual name *John*). According to our understanding of the concept of universal sentence, (1) is a universal sentence: its truth value is a function of sentences which attribute to John particular properties from a certain class. It is so because $p(\textit{to run})$ does not pick out one property but refers to a whole class of properties. The range of $p(\textit{to run})$ is not (need not be) a singleton.

Sentence (2) is also universal, since the name $p(\textit{John})$ is a common name – it denotes every past temporal part of John, and there can be more than one such element. The truth value of (2) is a function of truth values of sentences ascribing the property of running to particular past temporal sections of John. (2) can be construed as a sentence stating that there is a past temporal part of John which satisfies the predicate *runs*.

Sentence (3) is universal as well. Its truth value is determined by truth values of sentences stating – at different times – that John is running.

By analogy, the sentence *John will be running* will turn out to be universal in each of the three theories.

The A-view was (implicitly) endorsed by Ajdukiewicz so as to reject one of the arguments for the claim that change involves contradiction. We will now show that the argument also fails in the light of two other accounts of tense operators.

First, let us put forward a certain reconstruction of the argument. The starting point is a premise which states that the necessary condition of each change is that the pairs of sentences of the following type can both be true:

(1) *John was running.*

(2) *John was not running.*

(Perhaps it is also a sufficient condition of change – but we will not make use of this property.)

The second premise says that sentences (1) and (2) are logically contrary, that is, it is logically impossible that they are both true.

By adding the third premise, according to which there is change, we obtain an inconsistent set of premises, which entails an arbitrary sentence – in particular a logically false sentence, a contradiction.

It is the second premise that is false. If sentences (1) and (2) were singular sentences, then indeed, they could not be both true. Sentences

such as $P(a)$ and $\text{not-}P(a)$ are contrary – their joint truth is out of the question. However, as we have seen above, sentences (1) and (2) are universal regardless of the theory of tense operators. We will now show that (1) and (2) can both be true. According to particular theories, (2) will be interpreted as:

- L) *John p(not to run)*
- A) *p(John) is not running*
- P) *p(John is not running)*

Obviously, the following pairs of sentences are not logically contradictory:

- John p(to run) – John p(not to run)*
- p(John) is running – p(John) is not running*
- p(John is running) – p(John is not running)*

Neither are they logically contrary. It has already been discussed with respect to the L-view and A-view. In the case of the P-view, it seems particularly evident. If John was running an hour ago, and he was not running two hours ago, then both sentences are true: *It was the case that John is running* and *It was the case that John is not running*.

We might add that sentences (1) and (2) fail to be contrary for the same reason for which the following pair is consistent: $\exists x P(x)$ and $\exists x \sim P(x)$.

To sum up, we can say that each theory of tense operators discussed in this article is equally justified. The conceptual apparatus of categorial grammar does not rule out any of the three possible categories. The choice can be made on ontological grounds – by choosing a particular ontology. Thus we can say that categorial grammar, or rather its conceptual apparatus, is ontologically indifferent. Any formalization, including applications in computer science, must – at a certain level – represent expressions in such way as to secure the one-to-one correspondence between the formal structure of the representing object and the ontological structure (category) of the represented object. Categorial grammar opens up possibilities of describing the structure of expressions without immediately precluding any particular accounts which are possible due to the multitude of descriptions of the ontological structure of the objects to which those expressions refer.

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Urszula Żegleń

ONTOLOGICAL ISSUES IN NON-CLASSICAL LOGIC

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Abstract

The aim of the paper is a brief overlook at some philosophical issues of non-classical logic, and more strictly – modal logic, included also interpreted modalities in epistemic, temporal and deontic logic. I begin with some questions asked in philosophy of logic in reference to modal logic, especially in regards to its semantics given by Saul Kripke with application of the ontological notion of “possible world”. This notion will be in the centre of considerations. In the first chapter I shall make short remarks on Kripke’s model and on the characterisation of the relation between possible worlds. I shall point at the main approaches to possible worlds in philosophy of logic and some ontological issues. In the second chapter I shall focus on interpreted modalities, successively in epistemic, temporal and deontic logic. I shall be interested in replying to the question “what kind of ontology (with what kinds of objects) is implied by each of these types of logic?” .

Key words: modal logic, modality, interpreted modality, possible worlds, accessibility relation.

1 Ontological issues in modal logic

The rise of non-classical logics was a turning point in the history of logic: it set the stage for new metalogical research and shed new light on the philosophical problems involved in logic. Still, also the classical logic already entails certain philosophical presumptions, even though its

origin is closer to the foundations of mathematics than to philosophy. The Platonist or nominalist assumptions made in philosophy affect the choice of language, which either accepts or rejects general objects in its semantics; yet another assumptions, made from the position of realism or particularism, determine the character of the primitive terms, which correspond to qualities or individuals in semantics.¹

Philosophical issues (especially those about existence) involve quantification of linguistic expressions; certain philosophical preconceptions also form the basis for discussions concerning three basic semiotic functions: naming, denoting, and meaning. For philosopher especially rich in ontological assumptions and implications is non-classical logic which includes systems in which philosophical (e.g. modal or epistemic) notions are formalized, they are the most ontologically committed systems.²

Many non-classic logics are based on modal logic, whose ontological commitment is imposed on it by the possible worlds semantics. Contemporary logicians adopt philosophical interpretations of possible worlds in the hope that the domains determined by logical models in some sense correspond to the ontological universe examined by philosophers. Yet this gives rise to questions such as: what is a possible world? In what way does it exist? What is the difference between the actual world and a merely possible one? What relation do they bear to each other? What does it mean that a state of affairs exists in every possible world? Etc. As a result, logicians, or rather philosophers of logic, who raise these questions, revive the aged ideas of Leibniz, Kant, and Meinong. Let us consider these ideas by drawing on the now classical Kripke's semantics, in order to realize the depth of semantically induced ontological commitment of modal logic.

Kripke's semantics for normal modal logic consists in the well-known model $\langle K, G, R \rangle$, where K is a non-empty set (informally defined as a set of possible worlds), G is a distinguished element of K (interpreted as the "real". i.e. actual world), R is a relation between the worlds, called the "accessibility (or "possible relative") relation" (Kripke 1963: 68f). In one of the most familiar systems of normal modal logic,³ i.e. Feys' system T, the R

¹There is a vast literature on this topic in which the classical position is already Nelson Goodman's monography *The Structure of Appearance* (Goodman 1977).

²The concept of ontological commitment has been introduced to the contemporary philosophy of logic by Quine (1948) and Church (1958), in order to refer to ontological assumptions and philosophical issues entailed by them, especially the problem of existence in logic.

³The normal modal logic among its systems includes such known systems as: Feys' system T and C.I. Lewis's systems S4 and S5. The name "T" for Feys' system (con-

relation is reflexive, namely: for any w in K , wRw , which means that any world w is accessible from itself. Let α be short for the expression $Lp \rightarrow p$ (which is the axiom of necessity accepted in the system T). Assume that $V(\alpha, w) = 0$. That is the case if and only if $V(Lp, w) = 1$ and $V(p, w) = 0$. $V(Lp, w) = 1$ just in case the sentence p describes a state of affairs which occurs in each possible world accessible from w , and $V(p, w) = 0$ just in case p describes a state of affairs that does not take place at w . In order to guarantee the truth of α , it is enough to assume that each world w is accessible for itself. If at w there are some rational creatures, then it is plausible to believe that they know the state of affairs occurring in their own world. Thus accessibility may be intuitively construed as a certain cognitive ability pertaining to the inhabitants of a given world.

In a stronger system of normal modal logic, i.e. in S4, the accessibility relation R receives in addition the property of transitivity, namely: for any $w_i, w_j, w_k \in K$, $w_1Rw_2 \wedge w_2Rw_3 \rightarrow w_1Rw_3$. Let us assume that R is not transitive. This means that there are w_1, w_2, w_3 such that w_1Rw_2 and w_2Rw_3 , but $w_1 \not R w_3$. Then taking into account the axiom $Lp \rightarrow LLp$ from S4 we can consider the valuation V such that $V(Lp, w_1) = 1$ and $V(p, w_3) = 0$, thus $V(Lp, w_2) = 0$ and $V(LLp, w_1) = 0$. This means that the axiom $Lp \rightarrow LLp$ has been falsified. Thus, if the axiom $Lp \rightarrow LLp$ is valid in a frame, then its accessible relation is transitive.

The lines of reasoning presented above are based on the following description of a necessary sentence:

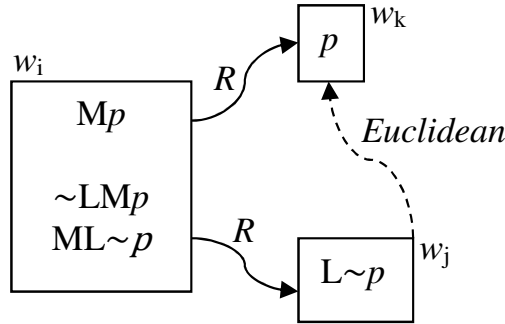
$$V(Lp, w_i) = 1 \leftrightarrow \forall w_j \in K (w_iRw_j \rightarrow V(\alpha, w_j) = 1)$$

Let us now illustrate the relation of transitivity with the following example: w_1 – the actual world, w_2 – the world in 1944, w_3 – the world in 1914; “ w_iRw_j ” means that the world w_i is accessible from the world w_j . In our example, the world in 1944 is accessible from ours (known from historical materials). Likewise, w_2Rw_3 , i.e. the world in 1914 is accessible from the world in 1944, that is to say, in 1944 there existed materials concerning the events of 1914. Consequently, since we can access the world in 1944 and the materials from that period also concern the events of 1914, we can access the world in 1914 as well. (Although for philosopher a situation can be more

structured in 1937) has been given by Bolesław Sobociński. Sobociński gave also the proof for the equivalence of T with the system M of Georg Henrik von Wright (Sobociński 1953). Hence in the literature T is often treated as Feys'-von Wright's system (as for instance in Kripke (1963) where it is said to be the system M(T) of Feys-von Wright). On the connections among the systems of modal logic and its history see: (Hughes, Cresswell 1972, a new completely re-written edition 1996, Latinov 2014) among others.

complicated and deserve more attention).

The accessibility relation becomes symmetric in the model of S5, where we have: $w_i R w_j \rightarrow w_j R w_i$. Symmetry of R follows from Brouwer's axiom: $p \rightarrow LMp$ which on the other hand can be obtained by the axiom $Mp \rightarrow LMp$, and the axiom $p \rightarrow Mp$ (which is obtained by T and also belongs to S5). If R would not be symmetric, that would mean that there would exist such worlds $w_1, w_2 \in K$ that $w_1 R w_2$, while $w_2 \not R w_1$. Then we could define such a valuation V that $V(p, w_1) = 1$ and for each w (if any) would be accessible from w_2 we would have $V(p, w) = 0$. This would mean that $V(Mp, w_2) = 0$, and then it is easily to see that $V(LMp, w_1) = 0$. Thus $V((p \rightarrow LMp), w_1) = 0$. Coming back to the axiom $Mp \rightarrow LMp$, it is known that it corresponds to the Euclidean condition: for any $w_i, w_j, w_k \in K$ $((w_i R w_j \wedge w_i R w_k) \rightarrow w_j R w_k)$. Similarly as in the case of the symmetry condition, it is seen that if R were not Euclidean, then $Mp \rightarrow LMp$ could be falsified (cf the diagram⁴).



The following description of the truth value of a possible sentence has been employed above:

$$V(Mp, w_i) = 1 \leftrightarrow \exists w_j \in K (w_i R w_j \wedge V(p, w_j) = 1)$$

Therefore, it should be accepted that if a world w_j is accessible from the actual world w_i , then also w_i is accessible from w_j . Let w_i be the actual world, i.e. the world of the occurring states of affairs, and w_j – a world from the near past. In that case, if the past world is accessible for a person living

⁴Here I address my special thanks to Wojciech Wciórka who commented this fragment and added the diagram. In describing the properties of the relation R I had the benefit from the comments of Marek Nasieniewski from the Chair of Logic at the Nicolas Copernicus University.

in the actual world (e.g. by virtue of recollection), then, if the person lived in the past at w_j , she was also able to access w_i (e.g. thanks to the ability to predict, forecast, envisage).

The examples given here might be debatable, since they have already been interpreted in a certain way, whereas the formal notation only allows to decipher formal properties of the relation R in various systems. The intuitive construal of accessibility as a certain cognitive capacity makes us consider R pragmatically and apply an epistemic interpretation to modal systems. If in turn the relation is conceived, say, temporally, then modal logic will become the basis for temporal logic. Our understanding of accessibility relation, therefore, determines the specific interpretation of modal logic: epistemic, temporal, deontic, topological, or yet another. Merely providing a model, however, is not sufficient to characterize modality, or even to answer the question of what modality is. Following Alvin Plantinga I repeat his view, according to which the model-theoretic structure is a pure set of theoretical constructions, with no connection to modal terms (Plantinga 1974: 126). A similar outlook has been presented by Marian Przełęcki (1974), who notes the insufficiency of model-theoretic devices for analyzing the philosophical problems implied by modal systems. Thus a new avenue opens up for research necessary for identifying objects occurring in Kripke's model. Various interpretations of modal logic will be left out here, but some accounts of possible worlds will be outlined, with focus on their nature and ontological status. In other words, the presentation of the most popular theories of possible worlds in contemporary philosophy of logic will serve as a means to ontologically characterize the domains relevant to modal systems.

The concept of possible world has a long philosophical tradition, dating back to Plato and revived by Leibniz (in his metaphysics). In contemporary philosophy of logic the following main approaches have been distinguished: (1) linguistic, (2) object-oriented, and (3) epistemic.

1. *The linguistic approach.* It is the most popular one which has been started by Rudolf Carnap (1946, 1947) in his attempt at solving the problems of analyticity, meaning and modality stated by W.V.O. Quine. In his earlier account "a state-description is a class of sentences which represents a possible specific state of affairs by giving a complete description of the universe of individuals with respect to all properties and relations designed by predicates in the system" (Carnap 1946: 50). The states-descriptions (which are bound to the language) are taken to represent possible worlds (although in Carnap's approach this notion does not imply any ontological issues). Treating possible worlds as sets of linguistic constructions is useful chiefly for logical semantics.

Models for modal systems are linguistic constructions in which modality has been connected to truth value. The distinguished value is truth, so the distinguished world is the actual world or the actual state of affairs constituted by a set of true sentences. A valuation function which has been added to Kripke's frame $\langle K, R \rangle$ has as assignment to determine truth-values (1 or 0) to an atomic formula α in a considered world w . The central idea of Kripke's semantics is that a formula of the form $L\alpha$ (necessary that α) is true at a world w that means that it is true in all worlds accessible from w through the relation R . While a formula $M\alpha$ (possible that α) is true at a world w that means that it is true in some worlds accessible from w through the relation R .

2. *The object-oriented approach.* This is a very differentiated approach according to which possible worlds are identified with states of affairs (by which properties of things are conceived) or with total ways things could be (different versions are given in Plantinga 1974, 1976, Stalnaker 1979, Lewis 1979). On this view, modality is a quality of things and as such it is modality *de re*.⁵

3. *The epistemic approach.* Possible worlds are certain possible cognitive situations or objects of intellectual processes (e.g. Hintikka 1962, 1974, Rescher 1974, 1975). A possible state of affairs can be also replaced with certain possible conceptual functions.

Some analogies can be drawn between these approaches and the accounts of universals; thus the interpretation of possible worlds as linguistic expressions is regarded as nominalist, the object-oriented interpretation – as realist, and the epistemic one – as conceptualist. Being aware of the status of possible worlds seems extremely important and probably crucial for understanding the nature of modality. Endorsing the first, linguistic standpoint only allows one to speak of modalities inherent in language. At best, the approach might be extended to various kinds of language described in the philosophy of language, so that one could analyze modal utterances occurring in them; e.g. in regard to natural language, it is possible to consider grammatical forms of the Polish language or use the known semantic analyzes of English;⁶

⁵Modality *de re* is regarded as an attribute of things and is distinguished from modality *de dicto*, an attribute of sentences (or propositions). These two kinds of modality have been introduced in the 12th century by Abelard, and then analyzed by St. Thomas Aquinas in his *Summa contra gentiles*. In this place I would like again to thank Wojciech Wciórka for paying my attention on Abelard's contribution to this issue.

⁶Scholars have discussed, inter alia, English constructions such as “possibly-so-and-so”, “this is a possible world for A to x ”. See Hacking 1975.

regarding particular languages – to analyze prescriptive utterances occurring in the language of ethics or law;⁷ with respect to artificial languages – to interpret theorems occurring in modal, epistemic, deontic, or other systems. It is believed, however, that on the linguistic account, modality can only be described as an operator, which could be indexically characterized in various ways, depending on the type of utterance.

Yet the semiotic analysis by itself already opens up new, broader avenues for further study. For instance, the analysis of prescriptive sentences (formalized in deontic logic and playing a normative role) would be fairly shallow if it was limited to characterizing syntactic properties of the deontic operator and did not take into account pragmatic (chiefly normative and also epistemic) aspects of utterances. If in turn, modality is granted an objective status (as *de re* modality), we clearly encroach on ontological ground, which immediately gives rise to a question about the role of modality in ontology. The answer to this question requires a definite theory of an object, in which the modes of existence of different kinds of objects which fulfil its domain, their structure (extrinsic and intrinsic), relations among them is specified. The epistemic approach, in turn, requires acquaintance with philosophical epistemology.

Taking into account the accounts of possible worlds mentioned above, and the problems posed by them, one may wonder if Kripke's model – presented in such a general way and accepted both for modal systems and their various interpretations – could be modified, e.g. into the following forms:

1. for the linguistic approaches:

$\langle C, C_i, R \rangle$,

only with languages of deductive systems and the relation R conceived as inferential entailment;

2. for the object-oriented approach:

$\langle K, S, R \rangle$,

where K is one's knowledge, S – objective states of affairs, and R is a relation of intentional correspondence.

3. for the epistemic approach:

$\langle G, L, R \rangle$,

where G – intentional states of affairs, L – language, R – also a relation of certain intentional correspondence.

⁷These issues have mainly been discussed by analytic philosophers; see the examples of classical positions in question: Black 1949, Hare 1952, Searle 1964.

Obtaining such models, however, would have to be preceded by a precise epistemic interpretation of modal systems. What is important in the accounts of possible worlds selected here is the distinction between objects filling up these worlds, i.e. whether they are constructs of language, of mind, or objective states of affairs. Some hold that there exist systems of actual objects (so called systems of surrogate-worlds), which are structurally isomorphic or analogous to the systems of possible worlds. In the logico-philosophical literature one can encounter the following examples of such systems:

(1) A system of states of affairs understood linguistically, or of Carnap's state-descriptions, characteristic of the linguistic approach and most popular in logical semantics. Here, possibility amounts to consistency, and actuality is interpreted as the value of truth. Such treatment of modality has been criticised by, among others, David Lewis (1968), who notices a vicious circle in Carnap's metalinguistic exposition and thereby points out the impossibility of defining consistency in terms of possibility. Yet besides the syntactic conception of states of affairs, one can also encounter a pragmatic account in the philosophy of logic (Chisholm 1979), where a state of affairs is defined in the following way: p is a state of affairs if and only if p is such that it is possible that there is someone who accepts p . The definition of a state of affairs as an object of acceptance rejects impossible states of affairs (which are not acceptable by any rational subject) and links existing states to a subject. If a subject accepts a state of affairs, then there must be a criterion for this acceptance. If this analysis is applied to formal systems, then the rules for acceptance correspond to rules of inference. Chisholm, however, was more interested in our real cognitive practice which not always is in agreement with ideal requirements of formal logic. In his analysis the concept of acceptance was strictly connected with the concept of rationality and his hierarchy of epistemic values whose list were enriched in sequent three editions of his *Theory of Knowledge* (1966, 1977, 1989).

One may either discuss the adequacy of Chisholm's definition or follow his general intuition that we only deal with states of affairs that are given in cognition, which thereby can be expressed in language in propositions, and only these propositions are to be accepted by a subject. Also possible worlds, due to their relation to subjects, are connected with the intentional realm. If they are placed in the intentional realm, then the states of affairs or objects filling up those worlds appear as objects of thought, whether in the form of propositions or concepts. In that case we may have to deal with false propositions or concepts referring to nonexistent objects.⁸ Consequently, should

⁸In logical semantics, the problem of nonexistent objects is considered e.g. with

the possible worlds not be interpreted in the framework of a suitable philosophical conception of intentionality? For Chisholm, however, propositions which are treated as the subclass of the class of states of affairs, the same like them belong to the ideal realm. But with regard to his internalist approach to traditional epistemological issues (especially in question of content and justification, and his view on certainty as the highest epistemic value rooted in selfconsciousness) it seems reasonable to appeal also to the intentional realm.⁹

Among other examples of surrogate worlds the following are worth mentioning:

(2) A system of things conceived in a certain (here: possible) mode in which we as human subjects represent our world (Stalnaker 1979) or a system of maximal states of affairs (Plantinga 1974, 1976).

(3) A system of combinatorial constructs (Quine 1968, Creswell 1972, Armstrong 1989).

(4) A system of Meinongian objects formally rendered by Terence Parsons (1974, 1978), Hector-Neri Castañeda (1974), and Nino Cocchiarella (1982).

All these systems of surrogate worlds are characteristic of the object-oriented account, although the last one might be taken to be better suited for the epistemic approach. What speaks in favour of the object-oriented account is the content-like treatment of Meinongian objects as certain sets of properties and a realist interpretation of Meinong's theory.¹⁰ On the other hand, the epistemic approach might be suggested by the fact that the Meinongian objects are conceived as objects of some mental states.

(5) The epistemic approach is associated with the above-mentioned system of mental constructs, made up of intentional states of affairs or intentional objects (Rescher 1974).

The list of systems of surrogate worlds presented here is certainly neither

respect to a theory of proper names, empty names, meaning, and denoting. See e.g. Kripke 1972, Lewis 1978, Munitz 1974, Pelc 1983.

⁹Chisholm's epistemology and epistemic logic (which in fact is an analysis of basic epistemic concepts without their formalisation) was the subject of many interesting critical discussions. In Polish literature an interesting critical overview of Chisholm's epistemology is given by Renata Ziemińska (1998) who is also the interpretator of his works into Polish language.

¹⁰The discussion concerning ontological status of nonexistent objects produces the same views as the problem of universals, i.e. (i) nominalism (here, originating in Russell and Quine), (ii) conceptualism (dating back to the Stoics and some scholastics, endorsed in different forms by Descartes, Leibniz, and Brentano), (iii) realism (having its source in Arabic philosophy and most explicit in Meinong's theory).

exhaustive nor mutually exclusive. Apparently, however, it is sufficient for our purposes to take into account only the three approaches to possible worlds put forward at the beginning, and thereby maintain that worlds are filled by: (i) linguistic objects (descriptions or sentences) characteristic of the linguistic account, (ii) intentional objects (such as concepts or propositions) characteristic of the epistemic account. Yet it is debatable what kind of objects should be ascribed to the object-oriented account: intentional, real, or maybe ideal?

Again, one can see the need to carry out further analyzes in philosophy, not in semantics. Meanwhile it is worth mentioning other issues discussed in the possible worlds semantics. One of them is the relationship between the actual and the possible worlds. Various resolutions of this problem have been offered depending on the accepted division of worlds, i.e. (A) on account of unity or contrariety of worlds two standpoints are distinguished: (1) one which treats all worlds equally, including the actual world; (2) one which distinguishes merely possible worlds from the actual world, which is supposed to have a distinctive ontological status; (B) on account of whether we underscore actuality or modality, we obtain actualism in a *de re* (Plantinga 1974, 1976, Stalnaker 1979) or *de dicto* version (Adams 1979), and the radical possibilism or in other words – modal realism, called sometimes “hyperrealism” (Lewis 1979, 1986) .

According to modal actualism, each possible world exists as actual (Platonism *sui generis*), although only one of them is really actual, which is understood in various ways inside this general view. Actuality is regarded as a state of world; for Plantinga, it is being momentary, for Stalnaker it is the state of affairs exemplified by the concrete world, i.e. the world we live in. “Being momentary” denotes here a quality pertaining to things, relations, states of affairs. Especially interesting and rich philosophical domain which could be taken into consideration here, is the domain of real world described in the existential ontology of Roman Ingarden in his *Controversy over the Existence of the World*.¹¹ On the other hand, in the *de dicto* version of actualism, where possible worlds amount to theoretical constructions from linguistic expressions, actuality corresponds to the value of truth. Possible worlds are treated as merely possible world-sentences, while the actual world is a world-sentence possessing the value of truth.

The problem of actuality is presented in a different light by the radical possibilism. All worlds (including the actual world) are possible worlds, and

¹¹I made such an analysis in another place, cf. Żegleń 1990: Ch. 5. Ingarden’s conception of modality. 2. Empirical possibilities (in Polish).

all possible worlds are equally real; all objects exist in them in an equally real way, and each possibility will be realized in them (radical realism). Intuitively "possible" in reference to a world means a "way that a world could possibly be", i.e. "a way that some world *is*". (cf. Lewis 1986: 7). Among possible worlds, one is distinguished as actual, but not because it differs from others but because we are its inhabitants. Possible worlds are similar to ours, since they are inhabited by equally concrete, spatiotemporally determinate objects. Still, as the inhabitants of our world we have certain non-relative characteristics not possessed by objects in other worlds. In David Lewis's account the very term "actual" does not express any absolute property which would distinguish a given world from merely possible ones, but it is an indexical label, fulfilling the same linguistic function as indexical words such as "here" or "now". "Actual" is understood as "each world w is itself the world w ". "Actual world" is therefore synonymous to "this world", which means that each world is actual in itself, and the inhabitants of other worlds can also describe their own world as actual. Worlds are isolated and there are no spatiotemporal relation between objects which belong to different worlds" (Lewis 1986: 7). This means that members of each world are closed in the spatiotemporal border of their own world and they are spatially and temporally connected only within one world.

Lewis's solutions enter deep into existential ontology and give rise to philosophical questions which open a new range of problems which cannot be solved by Lewis's theory itself. First of all, the exposition of his theory in his early works required better clarification. What does it mean that all possible worlds are equally real, that all objects exist in them in an equally real manner, and that every possibility will be realized in them? Surely, it is not the kind of existence scrutinized by metaphysics. Is it then legitimate to say that each world in itself is actual and autonomous – and only in this sense will each possibility be realized in some world? Lewis's primary interest is not, however, any existential ontology (in a strict philosophical sense), but an exact analysis of the logical space with regards to possibilia, especially those which under certain conditions make up the worlds. His possibilism is different from many classical versions of philosophical possibilism (or realism), though with regards to its modal extensionalism. His analyses are metalogical, nevertheless they are some means in doing analytical metaphysics, here metaphysics of modality (cf. Lewis 1986: 17).

An approach clearly distinguishing the actual world from possible worlds is proposed by the above-mentioned combinatorialism. The possible worlds

different from the actual world can be construed as different combinations of the entities filling up the actual world. The alternative worlds are sets of n ordered pairs which determine spatiotemporal location of various particles. Yet even here many ambiguities arise, e.g. how are these particles to be understood: are they independent beings or rather elements (in some sense) of objects occurring in the actual world?

Furthermore, a problem has been posed whether one individual could exist in more than one world. This difficulty, raised by Chisholm (1967) is connected to the problem of transworld identity. It is objected, however, that the concept of transworld individual is (i) contrary to the principle of identity, according to which, if two arbitrary individuals are identical, then they share all properties; (ii) it denies the transitivity of identity. What has also been underlined is the difficulty caused by the lack of criteria for identity of possible objects; Quine's (1948) question is well-known: is the possible fat man in this door identical to the possible bald man in the same door, or are they two separate men? And even if an individual is fixed in a world w on account of some characteristics, there is still no guarantee that the same properties are not possessed by another individual in this world.

For this reason, some regard this problem as meaningless. There are different solutions to this problem. One of them can be found in Lewis's (1968, 1971, 1986) counterpart theory. Identity has been replaced in it by the counterpart relation. He rejected transworld identity just in favour of his counterpart relation. Each particular is limited by a world, and an object existing in one world has its counterparts in different worlds. Still, there remains the problem of finding adequate criteria of similarity.¹² Lewis's theory is charged for being contrary to common intuitions about modal notions, although it seems to need a stronger philosophical foundation if it concerns ontological issues.

Yet another difficulty arises in connection to the choice of possible worlds which one wishes to consider in a model. On what basis should one pick out from an ontological universe the worlds which will be considered philosophically interesting? The accounts of possible worlds in philosophy of logic, briefly presented above, do not suffice in this regard: a definite philosophical ontology is needed in order to examine their ontological status, i.e. the mode of existence, to determine if they are independent or not, whether their existence is objective or anchored in a subject (in mind). Again, locating possible worlds in God's mind – as shown by Leibniz – raises

¹²Kit Fine in his critical notes to Lewis' *Counterfactuals* arose difficulties connected with Lewis' notion of similarity (Fine 1975).

a new philosophical question, known in the philosophy of logic as the Leibniz paradox, i.e. the question of choosing the best possible world, which was to be identified with the actual world. In the philosophy of logic, it is analysed and solved with semantic methods, by indicating the antinomial character of Leibniz's statement (cf. Adams 1972, Blumenfeld 1972, 1975, Plantinga 1973, Burkhardt 1980).

Certainly, the problems mentioned above do not exhaust all ontological issues involved in modal logic. Only those most frequently discussed in contemporary logico-philosophical literature have been touched on. For instance, a relatively little known interpretation of particular theorems of modal logic has been omitted, although they also determine certain ontology, in fact, a fairly rich one. Theorems of S5, regarded by many logicians as the most philosophically attractive modal system, seem to be of particular philosophical interest. For example, its theses could be ontologically interpreted and compared to known philosophical claims. The very axiom of S5, $Mp \rightarrow LMp$, seems interesting enough, as well as the similar Brouwer's axiom $p \rightarrow LMp$, whose addition to T produces the Brouwerian system (and added to S4 together with a special rule gives S5).¹³

Thus, again, a new avenue for philosophical research opens up. Should one not, therefore, present a definite conception of object (it is believed that the best suited one would be essentialist) and search it for solutions of the problems described here? Would a phenomenological Ingarden's ontology, an *a priori* theory of pure possibilities, not be the most adequate one? Kripke's model could be then compared with a model, reconstructed in this ontology, which defines the domain of its research. Furthermore, it is believed that acquaintance with domains of the actual world and a possible world would enable us to answer the question asked here: what is modality? The direction of research, which has been chosen here, seems to indicate that the analyzes initiated in formal logic lead up straight to ontology, at first to a formal one (rather in the sense of semantics), and then to a philosophical theory of object (or rather – a theory of possibilities). Does it not mean that the modality formalized at least in some systems in logic is the same modality that is revealed by a philosopher studying the structure of being (or reality)? The present article does not solve this problem, but pointing on the philosophical problems of modal logic is always inspiring for further investigations, which could lead to some more specific ontology implied by modal logic. It does not mean that the proposal of research headed towards

¹³The Brouwer's axiom has been introduced and analyzed by Oscar Becker (1930). More on this issue in a formal aspect see in (Hughes, Cresswell 1972, Ch. III).

phenomenological ontology is the only one possible, but it has been put forward with regard to the essentialist account of this ontology which favours such research (although it should be taken into account that the notion of “essentialism” can be quite differently understood in phenomenological and analytical ontology).

2 Ontological implications of non-classical logics. Metalogical notes on epistemic, temporal, and deontic modality¹⁴

Contemporary logic is a philosophically interesting subject for metalogical studies, chiefly thanks to its ontological implications and applicability to the analysis of natural language. Those studies emphasize the ontological significance of non-classical logics, whose creators drew inspiration from philosophy and metalogic (studies on foundations of mathematics). Modal logic is the fundamental part of non-classical logic; ontological implications of its theorems, and above all its possible worlds semantics, raise a lot of ontological issues. The modal concepts themselves are philosophical notions of rich intensional character. They have been given various meanings since ancient times; thus it is common to model epistemic notions (“to know”, “to believe”, “to be convinced”, etc.), temporal ones (“it has always been / will always be the case”, “it has been / will be the case”, etc.), and deontic ones (“to command”, “to forbid”, “to obligate”, “to permit”, etc.) on the central modal notions (“necessary”, “possible”, “contingent”, and their negations), called alethic modalities.

These concepts are counted among modal ones, because, as Hintikka (1963: 151) puts it, they can be analyzed in the same way as the normal, alethic modalities. It is, therefore, philosophically interesting to show these modalities in respect of their philosophical character, that is to say, the ontological problems implied by various types of modal systems, which are constructed by using the following methods: (1) as interpretations of Clarence Irving Lewis’ systems of alethic modalities (e.g. Rescher’s epistemic systems); (2) as axiomatized systems whose language is defined independently from Lewis’s systems, and only then is it given suitable semantics (e.g. Wolfgang Lenzen’s (1980) epistemic systems); (3) as formal systems whose construction is started with ready-made semantics (which can be a fragment of physical

¹⁴ (The considerations presented here were to a great extent prompted and influenced by the research conducted in the Department of Logic and Theory of Knowledge of the Catholic University of Lublin. My deep gratitude is to Prof. Ludwik Borkowski, who has supervised this research. In this part I shall use further (with little modifications) my analyses presented in Ch. II Interpreted modality (in Polish) of my book (Żegleń 1990).

or philosophical theory) and then a formal language for it is constructed (e.g. in the case of some temporal and deontic systems).

2.1 Epistemic modality

In this part of my paper I shall deal with epistemic modality. Both in their analyzes of epistemic notions, and in debates in the philosophy of logic, logicians address the problems raised by philosophers in epistemology. Thus there is a good reason for designing formal systems based on the notion of knowledge or belief, which is an allusion to the Platonic distinction between cognition in the sense of *episteme* (certain cognition) and *doxa* (opinion). Analytic studies emphasize the differences between these two types of cognition, pointing out that the cognition in the sense of knowledge, in contrast to belief, is certain and is not subject to the “true”/“false” qualification, while belief can be both true and false (Prichard 1973).¹⁵ In addition, it is customary to distinguish various forms of epistemic utterances, e.g. “knows that” from “knows how” or “knows where/when” (Hintikka 1962, Carr 1979).

Philosophy of logic raises many questions concerning these two conceptions of cognition, namely: does cognition in the sense of knowledge entail cognition as belief, and if so, is it possible to define the former in terms of the latter, i.e. as a true belief? Some scholars also underscore, in connection to Plato, the differences between cognition that refers to a proposition (*episteme*) and cognition referring to things (*gnosis*).

The philosophical issues discussed in epistemic logic often suggest a radical idea that this type of logic should be regarded as a formalized theory of knowledge. This, however, seems too unreasonable a requirement for a formal system, which employs methods different from the philosophical ones. Some authors (e.g. Ilkka Niiniluoto 1979) consider the deductive method of epistemic logic mainly as a way to clarify and analyze philosophical problems. This is the analytic view of philosophical issues, quite different from a methodological perspective of classical philosophical approaches. Then, it is not logic which is to serve as a formal tool to elucidate philosophical problems (which however, to a certain extent, it is able to accomplish), but it is philosophy or, more precisely, ontology and – in the case of epistemic logic – philosophical epistemology that is supposed to illuminate formal analyzes of philosophical notions.

¹⁵The author quotes Descartes when he says that just as cognition in the sense of *knowledge* is neither true, nor false, so colours are neither heavy, nor light.

Philosophy also inspires further formal investigations and criteria for the assessment of more adequate accounts of philosophical concepts. Yet, here we should bring out all limitations and simplifications imposed on formal systems which aspire to formalize philosophical concepts. The main cause of these limitations are differences between the rich content of philosophical language and the much poorer formal languages. It seems, therefore, that it is the logician with philosophical aspirations that can avail herself of the rich philosophical arsenal, which contains richer methods and is aimed at the maximalist account of reality. It does not mean, however, that philosophers should not deploy formal tools (say, to achieve greater precision of their analyzes), or that logicians should doubt the usefulness of their investigations in the field of philosophy, which allow us to reveal ontological assumptions of deductive systems or philosophical implications of their theorems.

Therefore, the considerations I wish to present here will, to a certain degree, combine formal and philosophical goals. I shall give some examples of formulas from epistemic logic to show how the above-mentioned modalities (which are philosophical concepts) function in a formalized form in deductive systems, and what philosophical consequences that has. In this way I shall bring attention to formal analysis of those concepts, i.e. to the ontological assumptions that led to certain formal accounts of them, as well as to ontological and formal consequences of the accounts. The present fragment of the work will belong to philosophy of language, founded, however, on a maximalist understanding of philosophy (as a coherent system of philosophical disciplines founded on ontology which is strictly connected with epistemology).

I shall begin the discussion of formal issues with some aspects of epistemic logic.¹⁶ It is constituted by deductive systems which formalize epistemic utterances. The most formally advanced among them are based on the concept of knowledge, i.e. they formalize utterances of the form: (1) “*a* knows that *p*”, i.e. *Kap*. Some (e.g. Malcolm 1973) distinguish two meanings of the verb *to know*: the strong one – in the sense of having analytic knowledge (e.g. “*a* knows that $p \leftrightarrow p$ ”), and the weak one – in the sense of having knowledge of a weaker assertion than the analytic knowledge (e.g. “*a* knows that London is on Thames”). The formalization of the second type

¹⁶I shall appeal to some systems presented in publications which belong already to classical works in the contemporary literature in the field of logic and philosophy. G.H. v. Wright’s book from 1951 is sometimes mentioned as that one in which first time epistemic logic has been presented. On the overview of epistemic logic in the recent literature see: Gochet, Gribomont (2006).

of cognition (i.e. in the sense of belief) was given by Hintikka (1962), who analyzes utterances of the form (2) “ a believes that p ”, i.e. Bap . Systems based on this type of cognition are also called doxastic and they define expressions such as: (3) “It is possible, for all that a knows, that p ”, i.e. Pap (Hintikka), (4) “ a considers it possible that p ”, i.e. Map , or “ a is convinced that p ”, i.e. Uap (Lenzen 1970), and (6) “it is compatible with all a knows that p ”, i.e. Cap (Hintikka).

A separate group of epistemic utterances is formed by expressions in which the operator “knows that” is weakened to “know if / where, when” or “knows how”, e.g. (7) “ a knows if p ”, i.e. “ a knows that p or a knows that not- p ”, which is formally rendered as $Kap \vee Ka\sim p$ (Hintikka), and (8) “ a does not know if p ”, i.e. “ a does not know that p and a does not know that not- p ”, i.e. $\sim Kap \wedge \sim Ka\sim p$, as well as (9) “ a knows how to do p ” (Hintikka).

Sometimes (e.g. Hintikka 1975, Niiniluoto 1979), epistemic logic is enriched with perceptual expressions such as: (10) “ a sees that p ”, i.e. Sap , (11) “ a hears that p ”, i.e. Hap . Finally, one can analyze utterances concerning cognition of another person: (12) “ a knows who b is”, i.e. “ a knows that ($b = x_1$) or a knows that ($b = x_2$), or ..., a knows that ($b = x_n$)”, where x_1, x_2, \dots, x_n are individual variables (Hintikka), (13) “ a knows b ”, (14) “ a remembers b ” (Russell 1910).

Here I shall refer to a formal analysis of epistemic utterances falling within range of true cognition, i.e. knowledge. I will omit, however, the whole large debate on the problem of true cognition, which requires the consideration on truth, and given the satisfactory conditions for ascribing knowledge (as in the analysis of a knows that p).

Epistemic logic analyzes true cognition only with respect to its linguistic characteristics, by formalizing cognition *qua* product. Epistemic utterances falling within range of true cognition were formalized by Rescher (1974), who offered one of the most formally advanced type of epistemic logic. Rescher considers certain cognitive utterances consisting of true sentences about epistemic concepts. The aim of his epistemic logic, therefore, is not to characterize the actual cognition. Nevertheless, the epistemological problems implied by this type of logic and the attempt to solve them seem philosophically interesting. Let us start with presenting Rescher’s systems. Their primitive term is the operator K , read as *knows that*.

A. Epistemic system corresponding to system T of normal modal logic; let us call this system T_e :

Axioms of T_e :

K1. $Kap \rightarrow p$

K2. $Ka(p \rightarrow q) \rightarrow (Kap \rightarrow Kaq)$

K3. $A \Rightarrow KaA$

A is a theorem of logic, the sign “ \Rightarrow ” can be understood as a metalogical operator of entailment; so K3 can also be laid down as a rule, which is known as the rule of epistemization (by analogy to the necessitation rule from normal modal logic).

RE. $\frac{\vdash A}{\vdash KaA}$

B. Epistemic system S_{e4} (corresponding to system S4 of normal modal logic) contains axioms of system T_e and:

K4. $Kap \rightarrow KaKap$

C. Epistemic system S_{e5} (corresponding to system S4 of normal modal logic) contains axioms of system T_e and:

K5. $\sim Kap \rightarrow Ka\sim Kap$

First, let us try to bring out some problems implied by these axioms. The interpretation of K1 makes it clear that we are dealing with true knowledge, i.e. $Kap \rightarrow p$: “if a knows that p , then it is the case that p ” (in semantic formulation the consequent is read as: the state of affairs described by p obtains), so what is known by the subject is really the case. On the other hand, K3 shows the scope of one’s knowledge – $A \Rightarrow KaA$: “if A is a theorem of logic, then one knows that A ”, so it can be assumed that one knows every theorem of the system. K4 and K5 point to one’s metaknowledge, i.e. awareness of one’s own knowledge or ignorance – $Kap \rightarrow KaKap$: “if a knows that p , then a knows that a knows that p ”; and $\sim Kap \rightarrow Ka\sim Kap$: “if it is not the case that a knows that p (which is read as: “ a does not know that p ”), then a knows that a does not now that p ”. K4, called the “KK principle” by logicians, is among the most discussed axioms (e.g. Hintikka 1962, Lehrer 1970, Feldman 1981).¹⁷ It expresses the ‘meta-’ character of cognition, which – as emphasised in philosophical epistemology – is achieved thanks to reflexivity of cognition. Reflexivity consists in the fact that every cognition, and so every cognitive act and each of its products, can become an object of other cognitive act or of other product (result) of cognition.

By stressing the ‘meta-’ character of cognition, logic points out not only that Kap implies $KaKap$, but also that they are equivalent, i.e. $Kap \leftrightarrow KaKap$. Thus, it is needed to consider the meaning of the KK principle. In

¹⁷The issue is deeply rooted in ancient and medieval epistemology: it was discussed by philosophers such as Plato in *Charmides*, Aristotle in *Nicomachean Ethics*, St. Augustine in *De trinitate*, and Thomas Aquinas in *Summa theologiae* II and *Questiones de quolibet* III (cf. Hintikka 1962: 107).

Rescher's systems discussed here, it is clear that the principle merely has a logical meaning, since axiom $Kap \rightarrow KaKap$ was introduced as a result of epistemic interpretation of the analogous axiom from the alethic system S4, i.e. $Lp \rightarrow LLp$. In philosophy of logic, the meaning of the KK principle is explicated by means of a precise linguistic analysis of the expression " a knows that a knows that p ", whereas – based on what has been said here about philosophical epistemology – one might think, without undermining formal analyzes, that what " a knows that a knows that p " means is that one can self-reflectively talk about one's cognition thanks to the fact that cognition of a sentence (or a state of affairs) p has been grasped as an object of cognition (self-reference of cognition). Some (like Hintikka) draw attention to a link between the KK principle and axiom K5, by claiming that both formulas express metaknowledge. Axiom K5, however, is usually mentioned as an example of a paradox of epistemic logic, given that ignorance leads to knowledge about this ignorance. Lack of knowledge is characterized in yet another way by a rule put forward by Rescher (1974: 103) (sometimes called the "principle of ignorance"), i.e. PI. $\frac{\sim KaA}{KaB}$ provided that $\vdash \sim KaA \Rightarrow B$. Let us illustrate PI with an example: take the sentence "John does not know who is the president of Poland in 2014" as $\sim KaA$. Can we conclude from this that John possesses other knowledge, e.g. KaB , where KaB is the sentence "John knows that Tusk is the Prime Minister of Poland in 2014"? The example seems quite intuitive although in the condition $\sim KaA \Rightarrow B$ there is no conceptual link between $\sim KaA$ and B .¹⁸ On the other hand, if we assume that $\sim KaA$ is true, then KaB and B are also true.

Other paradoxical examples have also been quoted, resulting from intensionality of the language of epistemic logic. Horst Wessel (1984: 30–31), for instance, analyzes the following sentence: "Lila Miller knows that Stendhal wrote *The Red and the Black*". The sentence is true although "Lila Miler knows that Beyle wrote *The Red and the Black*" is false, despite the fact that Stendhal and Beyle are the same person, which Lila is unaware of. Thus p in the expression Kap cannot be substituted with q even though $p \leftrightarrow q$ (intensional languages violate the principle of extensionality). In Rescher's epistemic logic the intensional epistemic language has been stripped of any content, since the cognitive expressions have been specified merely extensionally. Cognition in the strict sense has been characterized in this way – its definition runs as follows: $KaA \leftrightarrow K^*aB \wedge \vdash_s B \Rightarrow A$, i.e. " a knows that A if and only if a actually knows that B , and on the grounds of system

¹⁸Again I adress my thanks to Wojciech Wciórka for adding some remarks to this part of analysis.

S , A follows from B ". What does it mean that one actually knows that B ? Keeping in mind that knowledge discussed here is analytic in the framework of some deductive system, " a actually knows that B " means that B is an axiom, or that B is a theorem obtained in a deductive way, and subsequently A is deductively derived from B . Hence, "to know in the strict sense" means "to derive deductively".

Let us illustrate this with an example: let B be axiom A3 $Lp \rightarrow p$ from system T, which will play the role of system S from the above definition. Then, in T one can derive the theorem $p \rightarrow Mp$. According to the description given here, we assume that one actually knows axiom A3 $Lp \rightarrow p$ and deductively derives from it the theorem $p \rightarrow Mp$ in T, which means that by knowing A3 in T, one also knows the theorem $p \rightarrow Mp$. Apparently, the knower is treated here not as a person but as some perfect entity which – as axioms and theorems of Rescher's systems reveal – is omniscient.¹⁹ This omniscience, however, is not absolute but relative. Under a stronger sense of the epistemic operator "knows that" we get systems in which the knower has been formalized also as a deductive system. Thus Rescher's epistemic logic analyzes true cognition (understood as a result), characteristic of deductive systems.

Let us now examine how epistemic logic analyzes utterances falling within range of the second type of cognition, i.e. cognition in the sense of belief (uncertain). As said before, cognition considered as belief encompasses both truth values, so we cannot accept that if a believes that p , i.e. Bap , then the state of affairs (described by) p obtains. Thus the formula analogous to K1 from system T is rejected here, i.e. (15) $\neg Bap \rightarrow p$. Following Hintikka, however, a formula analogous to K4, that is, (16) $Bap \rightarrow BaBap$ is adopted, i.e. we can speak of the BB principle here. It can be read as follows: "if one believes that a state of affairs (described by) p obtains, then one believes that one believes that the state of affairs p actually obtains"; the reverse implication is refuted. Next, attention has been drawn to the link between the expressions "to know" and "to believe". Formally, this connection is expressed by the formula (17) $Kap \rightarrow Bap$, that is, "if a knows (it can be added: truly) that p , then a believes that p ". It is also specified when Bap follows from Kap , namely, "if a believes that p , and p is actually the case, and a has adequate evidence that p , then a knows that p ", which is

¹⁹In another way omniscience is interpreted in C.A. Meredith's system EM where there is the axiom according to which the knower knows the complete description of the world. Meredith belongs to first contemporary logicians who undertook the attempt at solving the problem of omniscience in logic (Meredith 1956).

written down as: (18) $Bap \wedge p \wedge Eap \rightarrow Kap$ (Niiniluoto 1979: 254). (18) is a sort of answer to the issue, much discussed in philosophy of logic and in epistemology, of the relationship between the two types of cognition (and mainly it is the answer to the traditional question “when (some-)one comes to knowledge?”. Yet the lack of formal specification of the operators with rich epistemic content indicates imperfection of formalization and is vulnerable to many philosophical objections. As mentioned before, the analysis of this sort of cognition requires a rich philosophical characterization, which is absent from the discussed formalizations.

Discussions centred around cognition in the sense of belief also concern certain important issues of philosophy of logic. One of the more notable among them is Moore’s paradox and the problem of quantification into modal contexts, particularly the epistemic ones. The issue connected with Moore’s paradox is summarised in the slogan “saying and disbelieving”, which means that a state of affairs (described by) p obtains, but a does not believe in it, that is, (19) $p \wedge \sim Bap$. Hintikka (1962: 64–76), for instance, analyzes formula (19), by considering the following situations:

- (1) when a is referred to in first person, i.e. “ p but I do not believe that p ”, that is, (20) $p \wedge \sim Ba_I p$ – such an utterance is paradoxical;
- (2) when a is referred to in third person, as in (19);
- (3) when someone gives an account of the situation, i.e. “ b believes that the case is as follows: p and a does not believe that p ”, which is formally rendered as: (21) $Bb(p \wedge \sim Bap)$. The paradox comes about only if $b = a$, that is, when (21) is about one and the same person.

The second problem concerns quantification into modal contexts. The discussion was initiated by Quine who impugned modal contexts due to their referential opacity. Let us quote a well known example from the logico-philosophical literature: (a) “ a knows that the dictator of Portugal is Dr. Salazar”. The sentence admits of two readings – the transparent one and the opaque one; according to the transparent interpretation, (a) is implied by: “ a knows that the dictator of Portugal is b ” together with “ $b = \text{Dr. Salazar}$ ”, and then (a) can be quantified, resulting in (21) “ $\exists x Ka$ (the dictator of Portugal is x)”. By contrast, on the opaque reading, (a) cannot be inferred from “ a knows that the dictator of Portugal is b ” together with “ $b = \text{Dr. Salazar}$ ”, and consequently we cannot quantify across the epistemic operator in (a). The objection against quantifying epistemic statements (and modal utterances in general) turns on the fact that they do not perform the referential function, at least according to the opaque reading. There are also other examples (“ a believes that Pegasus exists”, “George IV does not know that Walter

Scott is the author of *Waverley*”) which reveal unwelcome consequences of such quantification. It is clear that these difficulties, already known from the classical logic, are brought about by the existential interpretation of the discussed quantifier and are entangled in the problem of nonexistent objects.

The possible worlds semantics admits of existence of such objects in some possible world (Kripke). Accordingly, for instance, semantics for epistemic logic can include worlds compatible with one’s knowledge, in the sense that one can also possess a negative knowledge (ignorance). For example, if George IV did not know that Walter Scott was the author of *Waverley*, then a certain position concerning possible worlds admits of a world constituted by his ignorance (on the object-oriented construal, such a world may consist of possible states of affairs, i.e. those which he does not know to exist as well as those which he believes not to exist). It is already seen that in analyzes of this sort the knowing agent is regarded as a person. It is even clearer in formulas about two agents. Those formulas include (22) $KaKbp \rightarrow Kap$, that is, “if a person a knows that other person b knows that p , then the person a knows that p ”. For instance, if John knows that his friend Peter knows that Rafał Blechacz won the Chopin Piano Competition, then it follows that also John knows it. The formula illustrates the transmissibility of the results of cognition. However, adequacy of this notation requires a more definite specification of the meaning of the implication occurring here, because otherwise the interpretation of (22) is richer than the content of (22) itself. Similar formulation is not acceptable in the case of belief, that is, (23) $\vdash BaKbp \rightarrow Kap$, so it does not follow from “person a believes that other person b knows that p ” that “ a knows that p ”.

A separate group of epistemic utterances is formed by perceptual expressions occurring in the logic of perception. Also here one can propose a principle analogous to KK, i.e. the SS principle: (24) $Sap \rightarrow SaSap$, that is, “if a sees that the state of affairs (described by) p obtains, then a sees that a sees that p obtains”. The act of perception is metacognitive in character here. Operator S is specified by the following axioms (Niiniluoto 1979: 252):

- S1. $Sa(p \rightarrow q) \rightarrow (Sap \rightarrow Saq)$
- S2. $Sa(p \leftrightarrow q) \rightarrow (Sap \leftrightarrow Saq)$
- S3. SaT , if T is a propositional tautology
- S4. $Sa(p \wedge q) \rightarrow (Sap \wedge Saq)$
- S5. $Sap \rightarrow Sa(p \vee q)$

We should now inquire into the meaning of the formalized expression “to see”. A formalization of the results of external perception is hardly acceptable here. Clearly, the presented axioms define relationships holding between

sentences, or one can say that they express a certain attitude of an agent towards the sentences. Then perhaps we can speak of some kind of intellectual perception here: if, for instance, one grasps an implication in the intellectual way, then one intellectually grasps the antecedent only if one intellectually grasps the consequent as well; and likewise for other operators. But if we want to contend that the operator S formalizes the content of some intellectual perception, then one should appeal to philosophical epistemology, which offers the adequate account of this sort of cognition, i.e. direct cognition. By analogy to $K1$, the logic of perception is sometimes designed (e.g. by Niiniluoto) as containing the theorem:

S6. $Sap \rightarrow p$,

that is, “if a sees that the state of affairs (described by) p obtains, then the state of affairs (described by) p actually obtains”. This time, the expression “to see” is a name of an action (literally: of seeing). It can be said that if one perceives (sees) something, and it is assumed that one does not make a mistake, then it means that the perceived (seen) state of affairs (or object) occurs (exists). Hence the consequent of S6 is taken to be a result of external perception.

Still, some scholars (including Ayer and Hintikka) construe “to see” as an equivalent of “to appear”, so “ a sees that p ” means : “it appears to a that a sees p ” or “it seems to a that p ”. Then, for instance, one cannot infer from “ a sees white Tatra Mountains peaks gleaming in the Sun” that white mountaintops are gleaming, because in fact those might be bare, matt rocks. Analysis of the examples illustrating the results of external perception reflects in a way the discussions in the field of philosophical epistemology between presentationists (such as phenomenologists: Edmund Husserl, Roman Ingarden or in quite different way nowadays analytic philosophers as John Searle for instance) and representationists (including such classical analytic philosophers, like Moore, Austin, Ayer, and Price) concerning the object of external perception. On the traditional representationist conception, S6 understood as earlier is controversial.²⁰

I could quote further examples of formalization of the expression “to see” or other perceptual expressions, but due to a low degree of adequacy of these formalizations (from a philosophical point of view) it seems pointless. I had better choose one definite meaning of the expression (compatible with a philosophical account) and try to put forward – as far as possible – an adequate formal description of utterances of the Sap type. With an

²⁰I omit the whole debate on the nature of perception in epistemology and newer approaches in logic of perception.

epistemological account of perceptual utterances at hand, it would be possible to make out the differences between their various meanings. Yet this would be a semantic analysis, useful for elucidating the sense of perceptual utterances but utterly insufficient insofar as the nature of cognition itself is concerned. For in philosophical epistemology it is possible to distinguish many types of perception, and since it is a sort of direct cognition, an adequate account of it is possible only in the field of philosophical epistemology.

As I consider epistemological issues in their formal aspect, I should inquire into the semantics of epistemic systems and their problems. It is the possible worlds semantics. I have already mentioned, three accounts of possible worlds are the most popular ones: linguistic (started with Carnap), object-oriented (in different versions in David Lewis and Plantinga as main representatives), and epistemic (e.g. Hintikka, Rescher). The linguistic approach can be reconciled with the epistemic one because possible worlds are identified with a set of linguistic expressions which describe certain objects of intellectual processes. Thus sentences describing possible worlds are both about certain states of affairs occurring objectively (in ontological perspective) and about what is known or not known in those worlds (in epistemic perspective). I will leave aside formal characterization of world structures for particular systems of epistemic logic but I shall briefly discuss some of their interpretations.

First, let us try to use the possible worlds semantics to interpret some statements from the formal systems discussed here. Take axiom K1. $Kap \rightarrow p$, “if a knows that p , then the state of affairs (described by) p obtains”. It can be construed as saying that if an individual from the actual world knows that p , then in each possible world accessible from the actual world, the state of affairs (described by) p obtains. Since in the system T_e , from which this axiom is taken, the accessibility relation is reflexive, the state of affairs (described by) p occurs in the actual world. If we consider in turn systems in which the accessibility relation gains new properties, so that it is possible to access other worlds apart from one’s own, then one knows that p only if the state of affairs (described by) p obtains in all those worlds accessible from the actual world w_i .

I used here the condition defining the values of alethic formula $L\alpha$, i.e. $V(L\alpha, w_i) = 1 \leftrightarrow \forall w_j (w_i R w_j \rightarrow V(\alpha, w_j) = 1)$. In order to be able to interpret the theorems of epistemic systems, it is enough to replace operator L with K . It seems reasonable all the more because operator K expresses analytic knowledge, while analytic sentences are obtained in logic as true in every possible world (in Leibnizian spirit). Likewise, by analogy

to the systems of normal modal logic, we can interpret epistemic formulas in epistemic systems with accessibility relation regarded as transitive (S_e4 with axiom K4 suitable for illustrating this relation) and as symmetric (S_e5 with axiom K5 suitable, in turn, to illustrate symmetry).

Since, however, as follows from the above interpretations of Rescher's systems, the knowledge in question is analytic, and the knower is treated as a deductive system, it seems that the universe ventured in the possible worlds semantics will not be of much concern to a philosopher. Even if it is regarded most generally as encompassing the whole deductive knowledge, the discussion should still be directed towards philosophy of mathematics or philosophy of logic, and not towards the classical theory of being understood as the theory of reality. So if the crucial question faced by the possible worlds semantics is the question concerning the ontological status of possible worlds (mainly their mode of existence), then the answer should depend on the existence of objects in mathematics and logic. Besides, it seems that if Kripke's model is to be applied both to epistemic and normal modal logic, then it must, on account of the above analyzes, be modified in certain respects. These adjustments will above all depend on the ontological status of the realms of being to which the epistemic systems will refer. Accordingly, we propose the following modifications of Kripke's model:

I. $\langle C, C_i, R \rangle$,

where $C = (C_1, \dots, C_n)$ is a sequence of suitable sentential expressions and R – an inferential relation, which means that we are dealing with deductive systems (constituted by sets of linguistic expressions), which can stand to each other in relation of logical entailment. Thus it would be a model for Rescher's systems.

II. $\langle G, L, R \rangle$,

where G signifies intentional states of affairs taking place in one's mind, L – a language, R – a relation of certain intentional correspondence between those intentional states of affairs and the language. We can assume, therefore, that actualization is realized here by verbalization, since it is the language which corresponds to the actual world from Kripke's model.

III. $\langle K, S, R \rangle$,

where K is one's knowledge (true or not true), S – objectively obtained states of affairs, and R is also a relation of certain intentional correspondence between those states of affairs and the knowledge. This time actuality has been regarded as exemplification or concretization of knowledge in reality – as possible worlds are currently construed as one's knowledge. The concretization comes about in virtue of the classical criterion of truth (as

a certain correspondence between knowledge and its domain of objective states of affairs, as it is viewed from the realistic position).

It must be, however, taken into account that each of these models requires rich comments and evokes lots of controversial issues in different philosophical theories. Nevertheless it seems that these models cover the main layers of cognition (i.e. intentional states of affairs taking place in mind, their verbalized forms in language, and their concretizations in reality). Thanks to that, they can be assigned to different types of epistemic logic (i.e. model I to the systems which formalize the true cognition – knowledge, while two other models to the systems which formalize some aspects of cognition in the sense of belief).

2.2 Temporal logic²¹

The second type of modality that we are concerned of here, the temporal one, is among the oldest topics of logic and philosophy, as it was already considered by Aristotle and the Stoics. Temporal issues were vividly discussed by the Megarians (especially Diodorus Cronus), and in the Middle Ages – by Arabic philosophers and scholastics. Ancient and medieval analyzes of time are used today in constructing temporal systems. For instance, Diodorus's system has been reconstructed and shown to be identical with Lewis's system S4 or to be somewhere between S4 and S1.²² Formal analyzes in contemporary logic are carried out in the following ways:

(1) as historical studies started by Arthur Prior (1955, 1958) (see also Prior 1967, Rescher 1974, part I among others),

(2) as analyzes of tense, especially of perfective and imperfective forms (D.M. Gabbay 1976, Jonathan F. v. Bentham 1977, 1984); they are frequently labelled "tense logic".

(3) as analyzes of time based on philosophy of science, especially philosophy of physics (Rescher 1969); they consist mainly in formalization of methods of inductive inference (Prior, Rescher). Logic of this sort is often called "logic of time".

It is not always possible to make a clear-cut division between systems of tense logic and the logic of time. It often turns out that an analysis of tense involves some model of physical time, as seen e.g. in Prior's systems, who

²¹Here I give my analysis (with little modification) from (Zegleń 1990), p. 116-125 .

²²This was the work of Prior, who is considered the pioneer of temporal logic. Prior argued in favour of the first option by building a matrix for Diodorus's system which corresponds to system S4. However, Edward J. Lemmon has shown that this matrix is not adequate for S4, since it also makes true formulas which do not belong to S4 but to S4.2 and S4.3; cf. Prior 1957.

– starting with analysis of tense – achieved results enabling him to discuss physical and philosophical issues. For these metalogical reasons, I shall speak of temporal logic, without distinguishing between the two types. I will mainly use works by Prior (1957, 1967) and the philosophically interesting results achieved by Cocchiarella (1966), von Wright (1965), Lemmon (1977), and Rescher (1966, 1969).

Temporal logic consists of deductive systems formalizing certain temporal utterances (i.e. tensed sentences or simply statements built by means of a temporal operator). Temporal operators (treated here as temporal modalities) include:

- (1) Fp – it will be the case that p ,
- (2) Pp – it has been the case that p ,
- (3) Gp – it will always be the case that p ,
- (4) Hp – it has always been the case that p .

The operators F , P , G , H , appear for instance in Prior's and Cocchiarella's systems.

Operators with indexes:

- (5) $F_n p$ – it will be the case n days hence that p ,
- (6) $P_n p$ – it was the case n days ago that p .

Operators (1), (2), (5), (6) appear e.g. in Lemmon's systems.

Operators specifying temporal relations:

- (7) Ypq – p now and q later,
- (8) pTq – p and next q ,
- (9) $x < y$ – the instant x is earlier than the instant y ,
- (10) $x > y$ – x is later than y .

(7) and (8) appear e.g. in von Wright's systems, while (9) and (10) in Prior's.

By means of temporal modalities it is possible to define alethic modalities:

D1. $Mp =_{df} p \vee Fp$

D2. $Lp =_{df} p \wedge Gp$

D3. $Mp =_{df} p \vee Fp \vee Pp$

D4. $Lp =_{df} p \wedge Gp \wedge Hp$

Definitions D1 and D2 come from Diodorus Cronus: possible is what is or will be the case, and necessary is what is and will always be the case. These definitions are also adopted in contemporary systems: if D1 and D2 are added to Cocchiarella's temporal system, we get system $S_t4.3$ (i.e. analogous to the alethic system), and if Cocchiarella's system is enriched with D3 and D4, we get in turn S_t5 . Hence a suitable selection of axioms and definitions allows us to build temporal systems corresponding to Lewis's systems. D3

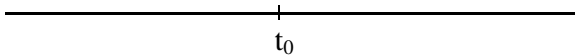
and D4 can be treated as accounts matching the Megarian conception of modality, according to which what is necessary is realized at each time. If one wishes to interpret these modalities in possible worlds semantics, then possible sentences would be true only in some possible worlds (actual, future, or past), while necessary sentences would be true in all possible worlds, provided that the worlds are temporally indexed.

From a philosophical point of view, the most interesting task would be to specify the ontological assumptions underlying temporal systems. The assumptions mostly concern the model of time intended for a formal characterization in a given system. The fundamental assumptions about time can be grouped as follows:

- (1) regarding the structure of time: do assume that time is linear, branching, or circular?
- (2) regarding density: do we assume that time is continuous (i.e. between every two instants there is another instant, later than the former and earlier than the latter) or discrete (not continuous)?
- (3) regarding determination: do we assume determinism?

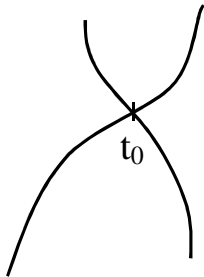
In order to bring out the differences entailed by these assumptions, we will lay down the theorems implied by them. On the assumption that time is linear we get, e.g. in Cocchiarella's system the following theorems:

- L1. $Pp \wedge Pq \rightarrow P(p \wedge q) \vee P(p \wedge Pq) \vee P(q \wedge Pp)$
- L2. $Fp \wedge Fq \rightarrow F(p \wedge q) \vee F(p \wedge Fq) \vee F(q \wedge Fp)$



On the assumption that time is branching, in Cocchiarella's system we get, for instance, the following theorem:

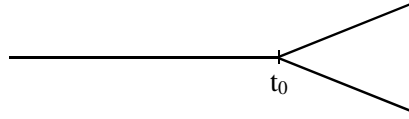
- B1. $P(p \wedge Fq) \rightarrow P(q \wedge Pp) \vee (q \wedge Pp) \vee (Fq \wedge Pp)$,
- where the future and the past are branching:



or another theorem:

$$\text{B2. } F(p \wedge Pq) \rightarrow F(q \wedge Fp) \vee (q \wedge Fp) \vee (Pq \wedge Fp),$$

where the future is branching:



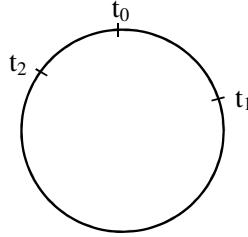
Finally, under the assumption that time is circular, for example in Lemmon's system K_t , we get theorems such as:

$$\text{C1. } Gp \rightarrow Hp$$

$$\text{C2. } Gp \rightarrow PGp$$

$$\text{C3. } Gp \rightarrow p$$

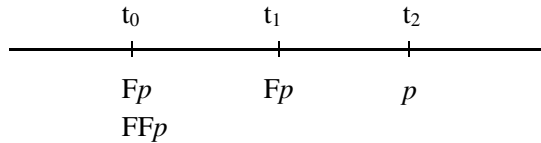
$$\text{C4. } Fp \rightarrow Pp$$



Clearly, these theorems illustrate the so called 'mirror image' (particularly evident in C1 and C4). The mirror image rule states that expression α entails an expression β in which a past tense operator has been replaced with a future tense operator and vice versa, so P is replaced with F , H with G , and the other way round.

Let us now illustrate the assumptions connected with density. As a consequence of accepting the continuity of time, we get, e.g. in Hamblin's system, the following theorem:

$$\text{D1. } FFp \leftrightarrow Fp$$



On the other hand, if time were discrete, given that Fp is true at instant t_0 (cf. the diagram above), there would be no guarantee that there is an intermediary moment t_1 – later than t_0 and earlier than t_2 – at which Fp is true. Thus, in the case of discrete time, it would be impossible to infer FFp

from Fp at t_0 , which makes D1 false.²³

Discrete time (with the last past moment) is illustrated by another theorem in Hamblin's system:

$$\text{D2. } GPp \leftrightarrow p \vee Pp$$

Also the following Hamblin's theorems reflect the discreteness:

$$\text{D3. } p \wedge Gp \rightarrow PGp \text{ (Diodorus formula)}$$

$$\text{D4. } p \rightarrow (Gp \rightarrow PGp)$$

$$\text{D5. } F\sim p \wedge FGp \rightarrow F(\sim p \wedge Gp)$$

D4 is a theorem that characterizes discreteness and enables us to obtain a logic of discrete time (e.g. as a result of adding D4 to system D of Dana Scott or Cocchiarella).

Yet another theorems characterize determinism or indeterminism. From a historical point of view, particularly interesting are reconstructions of Diodorus's and Aristotle's theses. For instance, we know the premises of Diodorus's famous Master Argument against indeterminists (chiefly against Aristotle): $Pp \leftrightarrow \sim M\sim p$ – "if it has been the case that p , then it is impossible that p should not be the case"; $L(p \rightarrow q) \rightarrow (\sim Mq \rightarrow \sim Mp)$ – "if it is necessary that if p then q , then it is impossible that q only if it is also impossible that p "; $\sim p \wedge \sim Fp \rightarrow \sim Mp$ – "if it is not the case that p and it will never be the case that p , then it is impossible that p ".

We have presented the most fundamental ontological assumptions of temporal systems. Hence, apparently, certain temporal systems describe commensurate ontologies, with models of time set by their assumptions. This gives rise to a question whether certain physical theories, or at least their fragments, constitute semantics of certain temporal systems. But how does this look from the philosophical perspective? What ontology is described by temporal systems? Can it be found among known philosophical ontologies, or do we need to put it forward yet? Should we not make use of some semantic analyzes based on the concept of possible world? After all, temporal logic constructs systems of possible worlds and investigates formal relationships holding between those worlds (Prior). It is also possible to direct further research towards already known philosophical ontologies and to choose, for instance, Ingarden's ontology. Would the universe described in it, which individuates objects with respect to their relation to time, not be a model for some temporal systems? Clearly, like epistemic logic, temporal logic involves a lot of unsolved issues which invite further – philosophical rather than formal – consideration.

²³I would like to thank Wojciech Wciórka for his correction of this piece of my text.

2.3 Deontic logic

The third kind of modality to be sketched here is the deontic modality. Deontic logic comprises deductive systems which formalize imperative utterances (ought-sentences). It serves as a formal device of deontology (also known as deontics), i.e. a general theory of obligation based on systems of norms. Although some scholars (e.g. Jerzy Kalinowski 1953) distinguish deontic logic (formal theory of all ought-sentences) from the logic of norms (formal theory of norms), they maintain that the former presupposes the latter, so they use both terms interchangeably. It seems reasonable that the name “deontic logic” has a broader extension and refers to all deductive systems which formally characterize the ought-sentences, whereas the logic of norms can be regarded as a subtype of deontic logic. In the case of formalizing legal norms we can speak of legal logic.²⁴ Nicholas Rescher, who is often quoted in research on non-classical logic, in his map of philosophical developments of logic in the field of ethical applications speaks about logic of action which includes deontic logic, logic of imperatives and logic of preferences and choices, i.e. games and decisions (Rescher 1968).

Deontic systems are constructed by means of deductive method. Axioms are selected from among ought-sentences taken from ethics, law, or legal science; alternatively, the choice of axioms can be purely intuitive. At the stage of constructing the system, the central focus is on its formal soundness, and only after the system has been completed the accent is shifted to the material consequences of such and such choice of axioms. At this stage, theorems derived from a given systems are examined as to their correspondence with ethical principles or legal norms. The crucial question is: how “rich” (in relation to ethics, law, or some legal theory) is the created system? On the formal side, deontic systems are treated as deductive theories of ought-operators. The following operators are considered fundamental (and at the same they constitute the elementary deontic modalities):

- the operator of obligation – O (corresponding to alethic necessity),
- the operator of prohibition – F (corresponding to alethic impossibility),
- the operator of permission – P (corresponding to alethic possibility).

In addition, in systems linked to decision theory, there is an operator of free choice (decision) – I (corresponding to alethic contingency).

Axiomatizations of deontic systems are usually based on the primitive term “ought to”, that is, the operator of obligation – O.

²⁴In Poland formal analyses of legal reasonings (started by Jerzy Kalinowski) were made by Edward Nieznański, Jan Woleński. Zygmunt Ziembiński among others.

Other deontic operators are introduced to the systems by means of the following definitions:

Definition of permission:

DP. $Pp =_{df} \sim O\sim p$

Definition of prohibition:

DF. $Fp =_{df} O\sim p$

Definition of free choice (optionality):

DI. $Ip =_{df} Pp \wedge P\sim p$

The issue of definability of deontic terms raises the question of whether they are to be defined merely internally, i.e. only by means of deontic terms, or externally, i.e. by means of other modal terms.

It is also worth noting that in some systems the deontic operators are interpreted either objectually or meta-objectually, either statically or dynamically. Deontic operators interpreted objectually make up ought-sentences which perform the prescriptive function (of a command or prohibition):

Op – it ought to be the case (it is obligatory) that p ,

Fp – it is prohibited (forbidden) that p ,

Pp – it is permitted that p ,

Ip – it is optional that p .

Apparently, a sentence (more precisely: a sentential variable) p refers to a state of affairs. In order to emphasize the objectual character of a statement, it is customary to use a different notation, i.e. to introduce symbol A which refers to an action that is obligatory, forbidden, permitted, or optional, symbol m which refers to a person which is supposed to perform this action, and a situational variable S ; in this way we get expressions of the form: “ m ought to perform action A in situation S ”, “Person m is permitted to do A in situation S ”, and the like.

Alternatively, deontic statements can be interpreted meta-objectually, when a sentence (more precisely: a sentential variable) p is understood as a norm (more precisely: a sentential variable representing a norm). On this construal, also the operators are read meta-objectually:

$Op - p$ is an obligation (order),

$Fp - p$ is a prohibition,

$Pp - p$ is a permission,

$Ip - p$ is an option (a free choice).

There is a problem with a proper understanding of arguments of such deontic operators, namely, what kind of sentences they are: assertoric sentences, like in classical logic, or ought-sentences. And if they are ought-sentences performing a prescriptive function, then could they be translated into as-

sertoric sentences playing a descriptive role? Another question is whether the ought-sentences, including a great deal of norms (ethical and legal), are logical in nature, that is to say, whether they can receive one of two truth values. Finally, are we allowed to speak of a normative inference, set its rules, provide the schemes? Is it a normal deductive inference with the sentences discussed here (but which: assertoric or normative?) serving as its premises?

The answers to those questions are not straightforward, they must be sought in methodology of legal or deductive sciences, in logical semantics, philosophy of language, and philosophical axiology. However, the answers given there differ from each other, depending on the philosophical and methodological presumptions. The most elementary among those are ontological assumptions concerning the nature of norms, which can be considered either in the realm of actual being (when a norm is ontologically dependent on a subject, as in the classical theory of being), in the realm of ideal being (when a norm exists objectively, independently from a subject – Platonism, contemporary phenomenology), in the realm of language (like in linguistic theories of norms, based on various kinds of philosophy of language), or in the realm of action (when a norm consists in rules defining agent's behaviour in society – nominalist theory of norms, founded on various types of praxist philosophy).

Ontological specification of the nature of norms determines, in turn, the methodological character of sentences counted among practical sentences. Deontic logicians, who formalize certain sorts of practical sentences, usually adopt a nominalist approach by treating norms as linguistic expressions with truth values. Yet, in discussions held in the framework of methodology of legal sciences, a position is admissible that strips norms of truth values due to the lack of analogy between validity of norms and the value of truth attributed to sentences in classical logic (Kelsen 1974). There are also dichotomies of positions regarding the possibility of translating ought-sentences into equivalent assertoric sentences (Schreiber 1977 – Weinberger 1977). The position admitting of the translatability also advocates the logical character of ought-sentences. Furthermore, it is sometimes claimed (Inhetveen 1977, Keuth 1974) that deontic logic formulates assertoric sentences about descriptive utterances, i.e. assertoric parts of prescriptive sentences. The problem of transition from assertoric sentences to ought-sentences (from the *is* operator to the *ought* operator) has also been among the crucial issues discussed in the analytic tradition since David Hume up today (Black 1964, Searle 1964).

Logicians who opt for prescriptive (not descriptive) nature of ought-

sentences in deontic logic, frequently write them down with an exclamation mark in order to emphasize that the arguments of deontic operators are imperative sentences, e.g. $!p$ as the argument of the expression with the operator $O!p$. As for the normative inference, one could employ the Aristotelian syllogistic of practical sentences, which was the first attempt to formally analyze such reasoning. Besides, rules can be regarded as imperative sentences performing a prescriptive function in a metasystem.

Thus deontic logic provides schemes of normative inference, by means of studying formal relationships holding between ought-sentences; this fact would be more evident, however, if the systems were created by using the assumption-based method, instead of the axiomatic one.

It is worth mentioning a formally interesting attempt to treat deontic logic dynamically, i.e. as a logic of change or action. Such an interpretation was put forward by von Wright (1963), who introduced to system's vocabulary the operator of transformation T . Formulas containing this operator (T -expressions) are read as follows:

$OpTq$ – it is obligatory to go from behaviour p to behaviour q ,

$PFpT\sim Fp$ – it is permitted to stop the prohibition p ,

$OOpTOq$ – it is obligatory to go from the order that p to the order that q .

It is easily seen that the introduction of the transformation operator admits of a dynamic reading of its arguments, which describe behaviour or action.

The above discussion has made it clear that deontic logic takes into account three aspects: syntactic – in formulating ought-sentences, semantic – in metalinguistic interpretation of these sentences, pragmatic – in emphasizing the role of action.

Concluding remarks

In conclusion it is worth to stress that modal logic with regards to its ontological commitment deserves special attention among the systems of non-classical logic. The paper focused not only on the alethic modalities, but first of all on interpreted modalities in epistemic, temporal and deontic logic. As has been showed these three types of modality are analyzed on three levels: syntactic, semantic and pragmatic. By their very nature, the discussed interpreted modalities are pragmatic in character, although this assessment is controversial in the case of temporal modality: is it not semantic in nature (since it examines relationships between sentences involving time)? On the other hand, however, analysis of temporal modality leads to

considerations about the realm of real being, and since they take existence into account, it is reasonable to point to the pragmatic character of this modality. Contemporary logic, therefore, formalizes pragmatic concepts, which play a role of suitable modal operators in a formal language, usually characterized axiomatically.

The modal concepts are then characterized semantically by means of Kripke's model. The model, generally speaking, is subsequently modified according to the needs of various systems. The following approaches are shared here: (1) the linguistic one, in which a possible world is a set of epistemic, temporal, or deontic expressions, (2) the object-oriented one, in which a possible world is a set of individuals existing in a possible way, (3) the epistemic one, according to which a possible world is a set of certain cognitive situations or of objects of intellectual processes. Each of the discussed types of logic implies distinct ontologies filled with different individuals; namely, the ontology of epistemic logic contains objects from the intentional realm (i.e. objects or states of affairs known or believed to obtain), the ontology of temporal logic contains time-related objects, belonging to the realm of real being; finally, the ontology of deontic logic contains items from the realm of obligation, whose description depends on the adopted philosophical position (e.g. in phenomenology it is ideal, in the classical theory of being – real but not independent).

Thus metalogical remarks made here point to rich ontological implications of non-classical logics, concerning the fields of study considered to be the domain of philosophical cognition. This is why contemporary logic is a philosophically intriguing subject, enabling one to get over purely formal accounts and reveal new ontological perspectives.

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Jacek Juliusz Jadacki
ON CRITERIA OF TRUTHFULNESS

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We are constantly seeing philosophical claims being made (...), professed at times fanatically, but those sages are as far as ever from agreeing on a common criterium of truth. They believe in their systemata, force this belief on others, damning those who dare to oppose, not knowing themselves what conditions separate truth from falsehood.

Henryk Rzewuski, *Wędrowki umysłowe*, 1851

How can one establish whether the proposition is true? Under the classical semantic definition of truth in the classical interpretation of this definition, the answer goes as follows: determine whether the proposition corresponds with the reality. Sceptics add: determine with absolute certainty, further judging such requirements that are impossible to satisfy. Bohdan Chwedeńczuk rightly dismisses this condition as excessively demanding (Chwedeńczuk 1984: 40–41). He believes, as I do, that various propositions can achieve different degrees of certainty and require various criteria of truth (Chwedeńczuk 1984: 40). By definition, there is no overarching, ultimate, "self-sufficient" (Gierulanka 1962: 37) criterium, i. e. a criterion "by which we should be in a position to recognize the truth of any true statement" (Kotarbiński 1966: 113). It even seems that anything pretending to be an "attribute" of "truth-diagnostic nature" would have to be an alternative of properties (see Żytkow 1977: 34–35). Meanwhile, any truth criterium would be "valid for a given type of sentences" (Kotarbiński 1966: 113). Moreover, it is often the case, for example in theoretical hypotheses, that one has to

settle for an indirect criterium of truth (Kamiński 1957: 286-287). “Searching for the absolute criterium of truth for any given sentence describing facts is a hopeless endeavour” (Czeżowski 1970: 25). Franciszek Gabryl rightly warns that “there will be as many [...] criteria of truth as there are sources of cognition” (Gabryl 1900: 246).

Again, “an adequate definition of truth [...] does not carry with it a workable criterion for deciding whether particular sentences in this language are true or false (and indeed it is not designed at all for this purpose). [...] Decid[ing] whether or not any such sentence is true is a task of science itself, and not of logic or the theory of truth.” (Tarski 1969: 69-70). We are therefore operating within the confines of the definition of truth as long as we stop short from exposing various “*modi operandi* of the notion of truth” (Rosnerowa 1975: 1255); and only these can be accepted as criteria of truth, their mere indication cannot be regarded as characteristics of truth.

REMARK 1. I wouldn’t go as far as to say, as Chwedeńczuk does, that all truth conditions are “discovered by logic” (Chwedeńczuk 1984: 60). It certainly doesn’t apply to truth conditions of such sentences as “Krynica Morska sits on Mierzeja Wiślana”. As recently pointed out by Adam Drozdek, “things are to be judged against proper standards and standards are to be applied as specialists see fit”; it falls under the authority of the scientist whether to judge things by “experiment, observation, measurement” or proof (Drozdek 1981: 105).

REMARK 2. Let me introduce the following terminology used in this paper.¹

Expression:

$$(1) \qquad (x)EPxQx$$

reads as: For each x : x is P when x is Q .

If expression ‘ Qx ’ in (1) does not include a predicate ‘ P ,’ it will mean:

- (a) (1) is a DEFINITION of ‘ Px ’;
- (b) the fact that Qx is the NATURE (essence) of the fact that Px .

If, further, expression ‘ Qx ’ in (refeq::1) is, and expression ‘ Px ’ is not an observation term (perceptual expression), it will mean:

- (c) the fact that Qx is an ATTRIBUTE — of diagnostic nature — of the fact that Px .

¹Comments on this terminology can be found in Jadacki 1986: 4-8.

Expression:

$$(2) \quad (x)CPxQx$$

means: For each x : if x is P then x is Q .

Again, if in (2) ' Qx ' does not have a predicative ' P ', it will mean:

(a) (2) is a CHARACTERIZATION (description) of the fact that Px and Qx , and, in particular, a DISTINCTION of the fact that Px and a DETERMINATION (separation) of the fact that Qx ;

(b) the fact that Px is a GUARANTEE of the fact that that Qx ;

(c) the fact that Qx is a FUNDAMENT (requirement) of the fact that Px .

If, further, ' Px ' in (2) is and ' Qx ' is not perceptual expression, it will mean:

(d) the fact that Px is a CRITERION (test) — a diagnostic guarantee — of the fact that Qx ;

should it be the opposite, it will mean:

(e) the fact that Qx is a SYMPTOM — a diagnostic fundament — of the fact that Px .

EVIDENTIAL CHARACTERISTICS

"[Common] understanding of truthfulness", writes Tadeusz Kotarbiński, "has it that one way of learning whether the sentence is true is to investigate things in question and find out if they indeed are as the sentence says" (Kotarbiński 1963: 56).

Che(a) For each proposition S and event Z {if S relates to Z then [if for a certain person O (Z is evident for O), then S is true]}.

This state of being evident — a "forceful" (Chwedeńczuk 1984: 79), "irresistible impression" (Chwedeńczuk 1984: 66) — can take at least two forms and be either objective or subjective (Biegański 1910: 168, 172, 174; Rzewuski 1851: 69).

1. PERCEPTUAL INTERPRETATION

Che(b) For each proposition S and event Z {if S refers to Z then [if for a certain person O (Z is perceived by O), then S is true]}.

2. INTUITIVE INTERPRETATION (Kotarbiński 1966: 113)

Che(c) For each proposition S and event Z {if S relates to Z then [if for a certain person O (Z seems necessary for O), then S is true]}.

Evidential criterion — clarity and distinctiveness of perception (Drozdowicz 1980: 243) — was first formulated *expressis verbis* by Descartes, but, as pointed out by Witold Rubczyński (Rubczyński 1906: 309), it dates further back to the stoics (Rubczyński 1906: 358).

REMARK 1. According to Albina Słomska (Słomska 1978: 72), Stanisław Leśniewski identifies perceptual interpretation with "intuitive criterion of common sense."

REMARK 2. Evidential characteristics are sometimes presented as if to suggest that they are propositions themselves, and not perceived or considered events, that are evident. Such "rationalistic account" of truth conditions became, to follow Tadeusz Czeżowski, obsolete even in deductive disciplines. "The significance of self-evidence [...] has been dwindling, now diminished to a heuristic function that no more than assists in guiding the mind on the road to scientific discovery" (Czeżowski 1970: 19).

STRUCTURAL CHARACTERISTICS

Kotarbiński argues the following. "Often, [...] we desire to know whether the sentence is true, although we possess no means to [directly] inquire how things stand. In that case we are compelled to [...] seek other CRITERIA OF TRUTHFULNESS (Kotarbiński 1963: 56).

Adherents of the syntactic definition of "truthfulness"² sometimes speak as if their vocabulary was offering not the definition but characteristics of "truthfulness," thus proposing an account that competes with evidential characteristics.

1. COHERENCE INTERPRETATION

Chs(a) For each proposition S [if for each proposition T (if T is true then S is coherent with T), then S is true].

²The relevant definition was provided in Jadacki 1988: 87-88.

The Chs(a) formula — as well as the operational interpretation presented below — can be any given interpretation that is either congruential or inferential. As a syntactic definition, it can also have a radical or a limited version. In the former, proposition T belongs to “the whole body of knowledge”, or at least to the “possibly broad set of propositions” (Chwedeńczuk 1984: 82), with “knowledge” signifying here all sets of acknowledged propositions, as opposed to all acknowledged propositions considered to be true. In the latter, the set of initial propositions (Chwedeńczuk 1984: 83) is composed particularly of propositions that are true under evidential criterion in its perceptual interpretation.

REMARK 1. The thesis on truth gradability (Chwedeńczuk 1984: 87-89), related to the coherent characteristics (or definition) of “truthfulness”, is tenable only if gradability is taken to indicate various degrees with which one can acknowledge propositions: the larger the set of propositions acknowledged as true cohering with the proposition in question, the better the credentials for it being acknowledged (see remark 2 below in section “Assertion Criteria” and Jadacki 1989: 140-141).

REMARK 2. Brand Blanshard’s view, which Chwedeńczuk terms a “closed interpretation of coherentism” (Chwedeńczuk 1984: 82), seems to be embracing the radical version of Chs(a). It is hard to imagine that Blanshard would endorse the idea that each coherent system of propositions is true, or that only propositions coherent with every proposition are true.

REMARK 3. A limited (evidential) version seems to exemplify points of view offered by Alfred C. Ewing and Francis H. Bradley, termed by Chwedeńczuk respectively as an “open interpretation” and “generalized interpretation of coherentism” (Chwedeńczuk 1984: 83-84, 81-82). In the latter, the legitimacy of the initial propositions might as well have been established based on a perception criterion. What else could be implied by such phrases as “their acceptance co-determines our experience”, “system-independent experience”, or that their validity “is forced by experience, perception-derived data” (Chwedeńczuk 1984: 83), or that they are “imposed by experience (sensations, impressions) (Chwedeńczuk 1984: 84)? On this reading, it would appear that the controversy between the proponents of evidential characteristics and structural characteristics is devoid of substance (Chwedeńczuk 1984: 103). To be sure, Chwedeńczuk maintains that in this last interpretation initial propositions “are COLLECTIVELY [my emphasis] shaped by coherence and experience, but these may be either accepted or not solely on the premise of coherence” (Chwedeńczuk 1984: 83). First, however, we are told that we can “reject them on the grounds that they do

not cohere with the system (Chwedeńczuk 1984: 83). I cannot imagine what constitutes such a system, or a set of acknowledged propositions, BEFORE initial propositions are already in place. Chwedeńczuk himself admits as much when indicating that baseline systems are in fact arbitrary systematizations built *ad hoc* (Chwedeńczuk 1984: 99).

If, however, in acknowledging propositions it would be impossible (in general interpretation) to refer to obvious perception, one would be left with little choice but to restructure it into its radical version.

REMARK 4. Chwedeńczuk challenges the coherence criterium by charging that it succumbs to *regressus in infinitum* (Chwedeńczuk 1984: 228). Such a criterium, argues Chwedeńczuk, must be phrased as a proposition, which, AFTERWARDS (!), must itself pass the test of truth (Chwedeńczuk 1984: 98-99). This applies to all sorts of criteria, both pragmatic ones, as demonstrated by Bertrand Russel (Chwedeńczuk 1984: 221), and correspondence-based ones (Chwedeńczuk 1984: 233, 235; see also Jadacki 1982: 78-82). Chwedeńczuk goes on to admit that “the scientist [...] does not refer to experience while verifying, confirming, recognizing or rejecting hypotheses. What he does refer to is what these experience-driven propositions relate to” (Chwedeńczuk 1984: 103). Thus, it suffices to distinguish between SAYING that such and such statement is true from DETERMINING its actual truth-value (Chwedeńczuk 1984: 233).

Similarly, given that Leonard Nelson’s paradox is correct, it can be reconstructed based on any characteristic of truthfulness. To quote Jan Łukasiewicz, “no criterion of truth can be PROVEN, since the trial of proving inevitably slips into circular reasoning or *regressus in infinitum*” (Łukasiewicz 1911: 85).

2. OPERATIONAL INTERPRETATION

Chs(b) For each proposition S [if for each proposition T (if T is coherent with S , then T is true), then S is true].

REMARK 1. As it has been long established (Chwedeńczuk 1984: 181), inferential interpretation of Chs(b) limited by perception (in a sense that the set containing T is composed of perceptual propositions) can be understood as a characteristic that provides the criterion for general propositions. This approach is encountered in pragmatist literature, among others. Precisely this would drive “justification, confirmation, testing” (Chwedeńczuk 1984: 162), “verification procedures” (Chwedeńczuk 1984: 167), “objective validation” of truthfulness (Chwedeńczuk 1984: 168) and “compliance” of

laws “with experience” (Szumilewicz 1977: 227). Those maintaining that “proposition is true only when the ensuing conclusions can successfully pass the test of experience” forget, however, that, to quote Izydora Dąmbska, “an experience-test can also be passed by conclusions following propositions which are not true” (Dąmbska 1931: 15). This is because it is nothing else but a “typical testing procedure by consequences, which serves to establish high probability of propositions” (Czeżowski 1970: 22). We must not forget a point made by Adam Wiegner who argued that “it is indeed not the truth of acknowledged propositions but their claim to *LEGITIMACY*, construed as ‘acknowledgement as true,’ which results from verification procedures in empirical sciences” (Wiegner 1963: 123).

REMARK 2. Chwedeńczuk’s dismissal of such an interpretation in favour of universal pragmatism (Chwedeńczuk 1984: 186-187) seems wrong if we were to reject his understanding of William James’ conception of utility as congruence with experience.

REMARK 3. It is not the case, as Chwedeńczuk would like it, that rational interpretation of pragmatism necessarily requires us to assume that James, Peirce (Chwedeńczuk 1984: 113) and Dewey (Chwedeńczuk 1984: 143), instead of the truth condition, provide a condition (or maybe a symptom) for *MEANING* or understanding of expressions (including propositions):

Dfps For each expression W and event Z (Z is a meaning component of W , when Z is a consequence of W).

“meaningfulness” because it can never be exactly clear when one is allowed to claim that a certain event is a consequence of a specific expression (or *BELIEF* in such expression if it is a proposition), regardless of this event being an emotional resonance, such as pleasure (Chwedeńczuk 1984: 118) or practical resonance such as action (Chwedeńczuk 1984: 118, 143).

Dfpr(a) For each proposition S and person O [O understands S when for each proposition T (if T is consequence of S , then O knows that T is consequence of S)].

Formula Dfpr(a), termed elsewhere “semantic directive of Charles Sander Peirce” (Chwedeńczuk 1984: 115, 171), is tenable if transformed into a characteristics providing a criterion for understanding (knowledge of meaning), not a symptom of it. If the prior knowledge of any imaginable consequence of a given proposition was required for it to be understood, it is unlikely that anyone would be ever able to understand any proposition.

Dfpr(b) For each proposition $0S$ and person O [O understands S when for each Z (if S refers to Z , then O knows how to achieve Z)].

Knowing how to realize the event related to the particular proposition is not only a necessary but perhaps also a sufficient condition for its understanding.

REMARK 4. Sometimes pragmatists speak as if utility was the symptom of truth.

Dsp(a) For each proposition S [if S is true then for each (or specific) individual O (S is utilizable for O)].

This, perhaps, is what Chwedeńczuk and others call “the most pragmatic of pragmatic maxims.”: “in short, ONLY THAT WHICH [my emphasis] is ‘true’ is beneficial in our manner of thinking” (Chwedeńczuk 1984: 168). Mind that Chwedeńczuk deliberately says “only” and not “all and only.” N.B. According to, for example, Bogdan Suchodolski (Suchodolski 1947: 403) and Zenon Szpotański (Szpotański 1969: 1341), utility (“fertility”) is, by pragmatist’s reading, not so much a symptom, but a criterion of truthfulness.

GENETIC CHARACTERISTICS

1. ACCLAMATION INTERPRETATION

1.1. UNIVERSALIST VERSION.

Chg(a) For each proposition S [if for each person O (O accepts S) then S is true].

1.2. SCIENTISTIC VERSION.

Chg(b) For each proposition S [if for each scholar B (B accepts S) then S is true].

REMARK 1. According to Chwedeńczuk, scientistic version (being perhaps not characteristics but definition of “truthfulness”) is formulated by Peirce (Chwedeńczuk 1984: 138, 171, 175). He further rightly notes that not all unanimously accepted propositions are true (Chwedeńczuk 1984: 17).

REMARK 2. Some argue, like Dąmbaska (Dąmbaska 1931: 15), that common consent is not a criterion but the very nature of truth. Nb. this overlaps perhaps with a specific (“incidental”) meaning of “truthfulness”, where one uses the term “to show solidarity with the attitude expressed in somebody else’s statement” (Kmita 1964: 119-120).

2. APPROBATION INTERPRETATION

Chg(c) For each proposition S [if for a certain person O (O accepts S) then S is true].

REMARK 1. The occasionally used authority criterion (Kotarbiński 1961: 147) can be regarded as a variation of genetic characteristics in approbation interpretation. It indicates persons whose beliefs are deemed to be true exclusively by virtue of them expressing such beliefs. It seems that, when he speaks of sociological and psychological notion of truth (Kubiński 1959: 183), Tadeusz Kubiński respectively means acclamation and approbation.

REMARK 2. Sometimes, somebody's approval of the proposition is not a criterion but a symptom of it being true (Chwedeńczuk 1984: 79). Chwedeńczuk rightly reminds us that there are indeed true propositions which have never earned anyone's approval (Chwedeńczuk 1984: 192).

KNOWLEDGE VS. TRUTH

It appears that the meaning of "knowledge"
precludes inexpressibility

Anna Wierzbicka, *Dociekania semantyczne*, PWN

Attempts at delivering genetic characteristics of truthfulness are rooted in the recognized correlation between truth, knowledge and acceptance. In order to reveal the actual patterns governing those interrelations, explanation of "knowledge" and "acknowledgement" will be needed.

DEFINITION OF "KNOWLEDGE"

Dfw For each proposition S event Z and person O {if S refers to Z , then [O knows about Z when (O accepts S and S is true)]}.

REMARK 1. In the classification offered by Michał Hempoliński, Dfw corresponds with the maximalist (persuasive-methodological-alethic) model of cognition (Hempoliński 1983: 69), but only when the acceptance complies with the rule of rational assertion (see the relevant section below). Chwedeńczuk suggests that Dfw is a purely pragmatists' invention (Chwedeńczuk 1984: 192). The universally accepted "truism" (Chwedeńczuk 1984: 57), he argues, would look as follows:

(a) For each proposition S , event Z and person O {if S refers to Z then [if (O accepts S and S is true), then O knows about Z]}.³

Formula (a) explicates, among others, a thought already present in Plato who proposed that he who offers a true proposition also knows (Chwedeńczuk 1984: 86). Pragmatists assume further:

(b) For each proposition S , event Z and person O {if S refers to Z then [if O knows about Z], then (O accepts S and S is true)]}.

It is difficult to recognize a true innovation, as shown by the example of Szymon Stanisław Makowski from three centuries ago: “[...] Truth is part and parcel of all knowledge, as a quality RESULTING [my emphasis] from its very essence. Thus, ‘truth’ is not only an essential predication of knowledge. [...] It is also not a predicate of merely accidental nature, as it would then be conceivable to think knowledge either without truth or with its opposition, this inevitably being falsity, a patent nonsense indeed” (Makowski 1979: 403-404).

REMARK 2. There arises a question whether somebody who acknowledges certain propositions GROUNDLESSLY does in fact KNOW about the event to which the proposition relates (or, more precisely, whether this event occurred). If the answer to the question is “no,” then the “truism” in (a) must be dismissed. Furthermore, some even judge the requirement for legitimate acceptance of the proposition as too weak.³

REMARK 3. We must also question (b). Somebody who knows about something may nevertheless reject the proposition, thus violating the (modified) rule of rational assertion $Rra(a)^*$ (see below, remark 1 in the relevant section). In such circumstances Dfw also seems to be untenable, with the following as more acceptable alternative:

Dwf^* For each event Z and person O [O knows about Z when O established that Z].

(note that the formula ignores the possibility that one may forget what was established before). Let us also note that some propose to characterize knowledge by distinction:

³This and one other issue addressed in the following remark and remark 1 in the section “Rule of rational assertion”, has been brought to my attention by Prof. Marian Przełęcki and Prof. Barbara Stanosz. I am also indebted to the former for helping me clarify the formula Cha in the section “Assertion Criteria”.

Ch(ds) For each proposition S , event Z and person O [if S refers to Z , then (if O knows about Z then S is true)].

KNOWLEDGE CHARACTERISTICS

Sometimes pragmatists' views on propositions can be interpreted in the following way (see above, remark 4 in section "Operational interpretation"):

Dsp(b) For each proposition S and person O [if S is true then [if O accepts S then O does so for certain benefit K (O achieves K)]].

If we now assume the above-formulated definition Dfw, we arrive at:

Chpw For each person O and event Z [if O knows that Z then O does so for certain benefit K (O achieves K)].

This formula — a pragmatist symptom of knowledge (Chwedeńczuk 1984: 197) — Chwedeńczuk calls "the instrumentalist rule" (Chwedeńczuk 1984: 197) or "hypothetical systemic component" (Chwedeńczuk 1984: 15-17). Failing to comply with the rule, "epistemological death", would lead to "biological death." (Chwedeńczuk 1984: 36).

REMARK 1. Chpw comes with reservations first indicated by Russell (Chwedeńczuk 1984: 221-222):

(a) acceptance of the true proposition is USUALLY beneficial: "to a significant degree, but not always", "regularly" (Chwedeńczuk 1984: 191);

(b) such benefits may take various shapes and sizes such as better understanding of the world, better coherence of one's beliefs or (greater) immediate satisfaction (Chwedeńczuk 1984: 57) — all of which is better and more inclusive than rejection of a true proposition.

REMARK 2. As indicated by Alfred J. Ayer (Chwedeńczuk 1984: 226-227), if proposed without such reservations, Chpw would be untenable even in the case of evaluative propositions.

ACCEPTANCE VS. TRUTH

We can speak of truth perhaps only when it's been demonstrated.

Adam Wiegner, *W sprawie tzw. "prawdy względnej"*, 1963

RULE OF RATIONALITY OF ASSERTION (Chwedeńczuk 1984: 52)

W sprawie tzw. "prawdy względnej,

Rra(a) For each proposition S and person O (if S is true then O should accept S).

REMARK 1. Rra(a) may strike some as downright silly, and calling it the "rule of rationality of assertion" may sound for some as a joke.

Let us consider the proposition "I will die on an even day". According to Rra(a), if this is true, then everyone should, and in effect are allowed to, accept it (see Rra(b) below). For Kazimierz Ajdukiewicz, this prediction turned out to be true. If Rra(a) was applicable, Ajdukiewicz should have accepted the proposition, although in 1956, when he first shared the premonition, he did not know whether it would materialize. If someone refuses to accept such consequences, Rra(a) would need to be amended into the following:

Rra(a)* For each proposition S , event Z and individual O [if S relates to Z , then (if O knows that Z then O should acknowledge S)].

Formula Rra(a)* should perhaps be supplied with one other requirement: " O knows that S refers to Z " (in the antecedent of the implication). Appropriate adjustments would have to be made also to Rra(b).

REMARK 2. As far as the relation between truthfulness and acceptance of propositions goes, at first Chwedeńczuk declares himself to be at loss (Chwedeńczuk 1984: 15). Later, however, he goes on to formulate a relation that may be interpreted along the lines of Rra(a), calling it a "normative component of the system" (Chwedeńczuk 1984: 13-17; see also Chwedeńczuk 1984: 66). He may be focusing on aptness, be we can still limit our understanding of his solution to truthfulness, since the latter is said to be the extreme case of the former (Chwedeńczuk 1984: 16).

REMARK 3. With this rule we may now be able to approach the issue troubling Anna Wierzbicka, namely the "absurdity" of the phrase "This is true but I do not believe it". It appears that we need not assume such a strong relation between "truth" and "what we are compelled to believe" (Wierzbicka 1969: 20).

REMARK 4. As suggested by Chwedeńczuk, it is the task of science to seek acceptance of true propositions (Chwedeńczuk 1984: 30). Let us just remind ourselves, after Dąmbska, that "truthfulness is not the sufficient condition

for propositions to be scientific” (Dąbska 1931: 1), and that, following Łukasiewicz, “not all true propositions are scientific claims” (Łukasiewicz 1912: 66). The question whether “truth is the necessary condition for claims to be scientific” (Dąbska 1931: 14) is to be answered in the affirmative, as demonstrated by Dąbska. That said, some scholars, like Łukasiewicz and Marian Smoluchowski, are nevertheless “maintaining that truthfulness is neither a sufficient, nor necessary condition for establishing scientific claims” (Czeżowski 1958: 68-69).

FACULTATIVE VERSION

If someone should accept a given proposition, he is also allowed to do it. Thus, the rule of rationality of assertion can be weakened into the following:

Rra(b) For each proposition S and individual O [if S is true then O is allowed to acknowledge S].

REMARK 1. It is incorrect to assume, as Chwedeńczuk does in defense of pragmatism, that “for the sake of our own utilitarian ends we cannot differentiate between what is true and what we accept to be true” (Chwedeńczuk 1984: 228; see also p. 224). Imagine to have once accepted a proposition which later turned out to be false. Or imagine accepting a proposition only TO A CERTAIN DEGREE, presuming, for example, that it is such and such — knowing at the same time that it IS (not to a certain degree) true or false. Wouldn’t such cognitive states testify to the possibility (and the need!) of distinction between truthfulness of the proposition and my accepting it? For this reason, such a distinction is not only, as Hempoliński puts it, one of four premises of the classical theory of truth (Hempoliński 1983: 64), but a baseline condition for any theory of truth in general.

It would be therefore ill-judged to think that in order to be considered true, sentence α must be checked against its positive truth conditions, those being conditions “allowing to ACCEPT [my emphasis] α as true” (Wolniewicz 1981: 73). It would be even less advisable to think that the “truthfulness of a proposition” hinges on STATING the existence of being (state of things) suggested by the proposition (Kamiński, Krąpiec 1962: 140).

REMARK 2. By employing James’ language (in his view pertaining to truthfulness in general), one can say about acceptance that it is:

(a) GRADABLE in terms of strength (Chwedeńczuk 1984: 154);

- (b) PERSONAL, as it is always acceptance by somebody (Chwedeńczuk 1984: 159);
- (c) CONTINGENT upon personal needs (Chwedeńczuk 1984: 156, 158, 183);
- (d) CO-DETERMINED by sensual components of experience (Chwedeńczuk 1984: 159, 183);
- (e) MOBILE, i.e. propositions are not accepted by themselves, they are such by resolution of specific persons (Chwedeńczuk 1984: 160).

It may be so that the idea of gradability (and other qualities) of truth can be traced back to, as implied by Jarosław Ładosz, “identifying truth as such with this or other effective criterion of truthfulness of propositions” (Ładosz 1961: 239; see above, remark 1 in section “Intuitive interpretation” and Jadacki 1989: 140-141).

REMARK 3. Wiegner urges the differentiation between the acceptance of a sentence and acceptance of it being true, “which in itself need not necessarily be accompanied by the former” (Wiegner 1963: 123). Here we are concerned only with this latter type (?) of acceptance, with the opposite being rejection of a proposition (on grounds of its falsity).

ASSERTION CRITERIA

We now face the question under what circumstances one is empowered to individually accept a proposition. The answer is: when one ESTABLISHED that the proposition was true.

Cha For each proposition S and person O (if O established that S is true then O is allowed to accept S).

The latter may be achieved by application of truth conditions.

REMARK 1. To quote Ajdukiewicz:

“I. Each conviction to which one applied truth criterion is accepted as legitimate.

II. No proposition can be legitimately accepted prior to application of a truth criterion [...].

III. If proposition A follows from premises consisting of propositions B, C, \dots , then legitimate acceptance of B, C must precede [...] justification of A on the ground of them” (Ajdukiewicz 1960: 11).

REMARK 2. According to Chwedeńczuk, it is the task of epistemologists to deliver precepts for the application of truth criteria (Chwedeńczuk 1984: 169). It seems to me that such a claim would be unsubstantiated if it implied that the theory of truth did not belong to epistemology.

EVIDENTIAL AND STRUCTURAL CRITERIUM

Peirce's view, which Chwedeńczuk calls "epistemological rigorism" (Chwedeńczuk 1984: 195, 205), can be taken to mean that the (ultimate) criterion for acceptance of propositions, or, to quote James, their "legitimacy" (Chwedeńczuk 1984: 148), or "acknowledgment-worthiness" (Chwedeńczuk 1984: 161), is whether it finds scientific justification. We therefore arrive at:

Dta(a) For each proposition S and person O (if S is scientifically justified then O is allowed to accept S).

On a side note, Chwedeńczuk substitutes implication formula Dta(a) (see Chwedeńczuk 1984: 195) with equivalent formula (Chwedeńczuk 1984: 204). The latter is also provided by Władysław Krajewski (Krajewski 1977: 85).

Now, if the proposition is scientifically justified, if given justification satisfying requirements prescribed by scientific research, it follows that if research permits evidential and structural criteria, then Dta(a) is based ultimately on these criteria.

ACCLAMATION CRITERION

Dta(b) For each proposition S and person O [if for each scholar B (B accepts S) then O is allowed to accept S].

To make Peirce's intent clear, the above formula should perhaps be phrased in the form of equivalence.

REMARK 1. It seems that it can be demonstrated how ineffective the acclamation condition of assertion is. Assume that a certain person O_1 is the first to voice his opinion regarding (the acceptance of) a proposition S_1 . If O_1 is not a scholar, he must wait to see what the scientific community has to say about S_1 . If, however, O_1 is the first scholar (to voice his opinion on the subject at hand), S_1 can be acknowledged only after other members of the interested community will do so. In that way nobody can individually and authoritatively (legitimately) accept any proposition. This is because, to follow Ayer, "truth is the matter of future consent" (Chwedeńczuk 1984:

225). We are then left with no other option but to accept what Russell calls “sociological prophecy” (Chwedeńczuk 1984: 219), that is, calling the proposition “true” “somewhat in advance” (Chwedeńczuk 1984: 239). Contrary to Chwedeńczuk (Chwedeńczuk 1984: 237-238), I am not inclined to think that the weakening of the discussed relation (unanimous acceptance of the proposition by all scholars as the truth criterion) would suffice to secure validity of a similar stance (see above section “Genetic characteristic”).

REMARK 2. Naturally, pragmatists’ views, especially those coming from James (Chwedeńczuk 1984: 148, 161), can sometimes be taken to mean that the proposition is justified, and therefore ready to be accepted, if it passes the instrumentalist test (see the above section “Knowledge characteristics”).

REMARK 3. James’ pragmatic directive clearly provides neither definition nor characteristic of truth. Used to guide behaviour in case of an observation that does not fit into the particular theory, understood as a system of hypotheses (Chwedeńczuk 1984: 160-162, 166, 192, 199)), it is driven by the optimization (mini-max) strategy, and when needed resorts to the condition of elegance or economy (see Dąmbaska 1931: 15; Gawecki 1944: 73; Szumilewicz 1966: 77; Szumilewicz 1977: 216, 230, 236). “Put simply”, writes Leon Chwistek, “it’s about technicalities of how we work and temporary conventions which can be rendered obsolete when required” (Chwistek 1961: 208).

According to Chwedeńczuk, acceptance of optimization strategy directive entails the systemic nature of knowledge and the world (Chwedeńczuk 1984: 202), as well as indeterminacy of truth and basic principles for competency (Chwedeńczuk 1984: 204). This indeterminacy does occur if what I call “CHWEDENČZUK’S UNCERTAINTY PRINCIPLE” (Chwedeńczuk 1984: 203) is legitimate. It goes as follows:

ZnCh “We are unable to pin down the specific experience and the corresponding proposition with equal accuracy” (Chwedeńczuk 1984: 203).

One could agree with such a principle if it would mean that assertions made in daily life always extrapolate from empirical studies and experience data never fully justify them (compare Jadacki 1985: 49-50).

Let us also note here, contrary to Chwedeńczuk (Chwedeńczuk 1984: 204), that on this account of “uncertainty” it is also our needs that would appear uncertain.

Let us make it clear, however, that it would be wrong to assume that “every proposition can [...] generalize [any] given experience” (Chwedeńczuk

1984: 203). Chwedeńczuk gives the following account of pragmatism: “It «happens» that sometimes a certain proposition is true, while at other times THE SAME [my emphasis] proposition is not” (Chwedeńczuk 1984: 206). One may agree with that because here the proposition means a proposition-sentence not a proposition-statement (i.e. content of the sentence). It is an illusion to believe that one still speaks the same language, in a logical sense of the term, after one has reconstructed the whole body of accepted propositions so that certain propositions-sentences — incompatible with experience under their previous meaning — could be accepted as true by attributing them a new meaning.

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Anna Jedynak

THE NOTIONS OF TRUTH AND THESIS IN AJDUKIEWICZ

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1. A brief outline of the conception of radical conventionalism.

Discussing any problem connected with the conception of radical conventionalism, we should begin with its brief recapitulation. The conception was developed in the 1930s, even before the publication of Tarski's paper (Tarski 1933), so during the period when semantics was rife with antinomies. Due to the antinomies connected with the usage of such terms as truth and denoting, the conception of language and meaning that was being developed at the time had to be asemantic. True enough, the conception of radical conventionalism involves syntactic and pragmatic terms but not semantic ones.

The thesis of radical conventionalism is a consequence of Ajdukiewicz's conception of meaning, it is therefore fitting to begin with it.

Meaning — as Ajdukiewicz wrote many years later about this period of his work — should be defined in a way that does not imply anything in terms of designating (Ajdukiewicz 1960, VI). Ajdukiewicz rejects both the associationist theory of meaning, seeking the meaning of expressions in the subjective sphere of consciousness of language users, and Mill's theory of connotation, seeking the meaning of expressions in the properties of objects described by those expressions, hence in the objective sphere. Ajdukiewicz seeks meaning in the language itself, in its rules of accepting certain sentences.

The meaning of an expression is — informally speaking — its way of functioning in a language. Ajdukiewicz first uses an informal concept of

meaning, only later presenting its full definition. Relating his views here, I intend to do the same.

Apart from phonetic and syntactic rules, language is also governed by meaning-rules. In the overall conception, they play an important part. Meaning-rules (also called meaning-directives), or rules of sense of the language *L*, prohibit the users of that language to refuse the acceptance of certain sentences of that language, because that would mean violating rules of assignation of meanings to propositions characteristic for the language *L*.

We can distinguish axiomatic, deductive and empirical rules of meaning. Axiomatic rules of meaning of the language *L* requires everyone who wants to use the expressions of the language *L* according to the meanings ascribed to them in this language, the unconditional acceptance of certain sentences of that language. These sentences include, for instance, axioms in axiomatic systems, and *a priori* obvious sentences of natural language, e.g. 'each human is a human.' A sentence such as this points to an axiomatic meaning-rule that demands the sentence be accepted by everyone who uses the expressions 'each' and 'is' in the meanings they are ascribed by the Polish language. The range of the axiomatic meaning-rule is the class of sentences that should be accepted according to that rule.

Deductive meaning-rules requires everyone, who wants to use the expressions of a given language according to their meanings, to accept certain sentences from that language in view of previous acceptance of other sentences, that is, the willingness to draw particular conclusions from particular premisses. The range of the deductive meaning-rule is a class of ordered sentence pairs (or pairs of the type: class of sentences — sentence), such as that the first and second element of each such pair are bound by a relation determined by this deductive meaning-rule. One such example of a deductive meaning-rule is the detachment rule, its range being all the substitutions of that rule.

Empirical meaning-rules demand the acceptance of certain sentences in view of experiencing certain sensations. For instance, one who is experiencing pain cannot in such a moment refuse to accept the sentence 'it hurts.' The range of the empirical meaning-rule is the class consisting of pairs of the type "sensory data"—"sentence," so that the elements of each pair are bound by a relation determined by this empirical meaning-rule.

Empirical meaning-rules can be simple or compound. An empirical rule is simple when the field of the relation determined by the rule consists only of sensory data, and it is a compound when separated from experiencing certain sensory data, also some other conditions have to be satisfied in order

to preclude refusal to accept a sentence determined by this rule. These conditions, together with perceptual data, comprise empirical data. Such conditions may include a number of earlier data, or unspoken judgments about the normalcy of a given situation, or certain other kinds of data.

The expressions whose meaning is characterised in empirical meaning-rules are called expressions with simple or compound empirical meaning (according to the kind of empirical meaning-rules they occur in). Ajdukiewicz maintains that the names of external objects and of their properties seem to have compound empirical meaning, whereas names of mental objects and of their properties usually have simple empirical meaning.

Ajdukiewicz refers to the languages that comprise all the aforementioned kinds of meaning-rules as empirical languages and to the languages that comprise only axiomatic and deductive meaning-rules as discursive languages.

We can distinguish languages that are connected or disconnected, closed or open.

The notion of connected and disconnected languages is based on the notion of a direct meaning-relation between expressions. Two expressions are directly meaning-related, when both belong to the same element within the scope of a certain meaning-rule in the language they belong to. The expressions A and B of language L are indirectly meaning-related, when they are not directly meaning-related and there exists in the language L such a sequence of expressions $C_1 \dots C_n$ that a direct meaning-relation holds between every two successive elements of the sequence, as well as between A and C_1 and B and C_n .

A language is open, if there exists another language that comprises all expressions of the first language and has the same meaning-specification, and moreover, comprises expressions not belonging to the first language, out of which at least one expression is directly meaning-related to an expression from the first language, while its meaning does not coincide with the meaning of any expression from the first language. A closed language is a language that is not open.

If an isolated part of a language exists, i.e. a proper subset of expressions of the language whose elements have no meaning-relations with the elements of the remaining subset of expressions, then we call it a disconnected language. If such an isolated part does not exist, then the language is connected.

According to Ajdukiewicz, only closed and connected languages are languages in the strictest sense. He writes:

... when we speak of 'languages' in what follows, we shall be referring only to closed connected languages. Closed connected languages alone deserve the designation 'language', for the so-called 'open' languages are really but fragments of closed languages; and non-connected languages are merely loose conglomerations of several connected languages. (Ajdukiewicz 1978: 58)

The meaning of expressions and the complete scope of meaning-rules determine one another. The question arises whether introducing new expressions into the language, and specifying their meanings through new meaning-rules by which those expressions are meaning-related with the old expressions, leads to a change in meaning of the latter or not. The situation is different for closed languages and different for open ones, but all matters connected with open languages were not really of interest for Ajdukiewicz in the period when he was developing the concept of radical conventionalism. Hence, we are going to restrict ourselves here to closed languages. Now, if to a closed language we add a new expression, not meaning-related to any of the old expressions, the language becomes disconnected (unless it already was so earlier), and the old expressions, becoming an isolated part of the enlarged language, do not change their meanings. If, however, the new expressions are meaning-related to the old ones, then either they affect a change in meaning of the latter or not — if each of the new expressions has exactly the same meaning as one of the old ones.

In order to present Ajdukiewicz's definition of meaning, we first have to introduce the notion of the matrix of a language. The matrix of a language is a table showing the sum total of the scopes of the particular kinds of meaning-rules.

Its first part shows the sum of the scopes of axiomatic meaning-rules and consists of lines, each one of which is a sequence constructed from all expressions appearing in a certain axiom (including the axiom itself) and ordered according to a specific principle.

The second part of the matrix shows the sum of the scopes of deductive meaning-rules and consists of lines, each one of which is an ordered pair of sequences. These sequences are made up of the domain or range of deductive meaning-rules, in the same way as the lines making up the first part of the matrix.

The third part of the matrix shows the sum of the scopes of empirical meaning-rules and consists of pairs, the first elements of which are empirical data, and the second elements are sequences of expressions, which make up

the sentences coordinated with those empirical data by empirical meaning-rules.

Ajdukiewicz defines translatability and meaning on the basis of the notion of matrix:

... S and S' are translatable into each other by R if and only if: both S and S' are languages; R is a one-to-one correspondence which associates with each expression of S an expression of S' , and vice versa; and the correspondence R is such that under it (i.e. by the replacement of expressions of one language with their R -associates in the other language) the matrix of S transforms into the matrix of S' and the matrix of S' transforms into the matrix of S A in S is identical in meaning with A' in S' if and only if both S and S' are languages; A is an expression of S and A' is an expression of S' ; and there is a correspondence R such that S and S' are translatable into each other by R , and the relation R holds between A and A' . (Ajdukiewicz 1978: 60)

And on the basis of this, by abstraction:

The meaning of A in S is such a property of A in S that it also attaches to A' in S' if and only if A' in S' is identical in meaning with A in S . (ibid.)

And for expressions of the same language:

Two expressions of a language are called 'synonymous' in case they are isotopic respecting the matrix of the language (i.e. in case the matrix is unchanged, apart from the order of its lines, when the two expressions are exchanged in it). (ibid.)

Meaning expressed in such a way plays an important part in the whole conception. Ajdukiewicz calls the sum total of the meanings of a closed and connected language its conceptual apparatus, and the set of theses of such a language, i.e. the sentences that one has to accept when speaking this language, he calls a linguistic world-picture.

Using those concepts, Ajdukiewicz formulates the main thesis of radical conventionalism, which in one of its formulations says that the linguistic world-picture depends on the choice of the conceptual apparatus. This is the most general formulation. In its fortified version, which Ajdukiewicz was mostly interested in during the thirties, there is an additional assumption that there exists at least two different conceptual apparatuses. This condition means that there exists at least two languages that are in no way meaning-related, and this not for the alleged reason that they refer

to different fragments of reality, since they are both closed and connected. Those languages represent two different points of view, from which the same reality manifests in different ways but in both cases in a complete way. The same experiential data make us pass different judgments, depending on which conceptual apparatus we are grounded in. Those judgments are not contradictory and cannot be such, since they cannot be in any way comparable due to the lack of mutual meaning-relations. Neither are there any meaning changes possible within a closed and connected language, since the change in meaning of even one expression of such a language leads to the change in meaning of all its expressions, and so a shift to a different conceptual apparatus.

The assumption that at least two different conceptual apparatuses exist makes for the originality of this thesis of radical conventionalism but also opens up the possibility of putting it to question. Later, Ajdukiewicz did not really question it but rather abandoned it, because he abandoned the notions needed for expressing it — the notion of a closed and connected language, and the notion of a conceptual apparatus as a set of meanings of the expressions of this language. Later, he used the notion of the conceptual apparatus^{1*} as a set of meanings of expressions of an open language, and instead of the world-picture — the notion of the world-perspective, a set of sentences derived according to the rules of an open language. Abandoning these notions neither led to the abandonment of the thesis of radical conventionalism in its weaker formulation (the set of theses of a language depends on its rules) nor the directive conception of meaning.

As we can see, the basic theses of Ajdukiewicz's conception say nothing about objective reality but only about linguistic reality. Later on, it led Adam Schaff to distort Ajdukiewicz's views (Schaff 1952) and to interpret them as idealism. This is what Ajdukiewicz himself said about it:

I directed my efforts towards showing that for every language there are certain rules for asserting sentences, which are in force in the sense that anyone violating them would show that he or she does not speak that language. From the notion of rules of a language I derived the definition of meaning of its expressions, calling the totality of those meanings the conceptual apparatus of the language. In turn, I have called the set of all theses of a language, i.e. the sentences that the language rules lead us to accept, a linguistic world-picture. This designation was deceptive since it suggested something else than it was

^{1*} In Polish, Ajdukiewicz changed the formulation of this notion slightly from "aparatura pojęciowa" to "aparat pojęciowy," while in English, in both cases the expression "conceptual apparatus" is used.

supposed to: it was easy to understand by a linguistic world-picture not the set of theses of a particular language but the set of its true sentences. Due to this shift in meaning, some people had distorted the assertion I called the thesis of radical conventionalism, which claimed the world-picture was determined by the choice of conceptual apparatus (which comes down to the trivial assertion that the set of theses derived by means of the rules of the language depends on what those rules are). Namely, the assertion that the set of theses of a language depended on the choice of conceptual apparatus was replaced by the assertion that the set of true sentences of a given language depended on the choice of conceptual apparatus and in consequence, that the world we accounted for through those true sentences depended on the conceptual apparatus. This was denounced as idealism. However, it was not my assertion that had been idealistic but what it was replaced with. (Ajdukiewicz 1960, VII)

In fact, Ajdukiewicz is grounded in the classical conception of truth and is a realist consistently critical towards idealism. As is evident from the above quote, distinguishing the notions of truth and thesis is in his view of paramount importance for avoiding an idealistic interpretation of conventionalism, since he sees as idealistic each instance of abandoning the classical conception of truth in favour of reducing the notion of truth to intralinguistic (syntactic) notions. Hence, pointing to the non-coextensiveness of the notions of truth and thesis is supposed to be the defence against an idealistic interpretation of conventionalism.

Ajdukiewicz often presented his view on the non-coextensiveness of the notions of truth and thesis or demonstrated non-coextensiveness through examples (Ajdukiewicz 1960, VII; 1965, 161, 162, 182-183; 1978, 79-84, 151-153). However, he never presented the issue in a full and exhaustive way. This was not an accidental oversight, since Ajdukiewicz wrote his papers on radical conventionalism in the period when semantics was rife with antinomies, and so he was very meticulous not to use in his conception anything that would suggest the possibility of comparisons involving semantics, for instance comparisons between the notions of truth and thesis or meaning and designation. Therefore, it is not easy to reply to the question about the relation between the notions of truth and thesis. Those texts by Ajdukiewicz which feature the classical conception of truth and in which the author asserts anything about the relation between the extensions of the notions of truth and thesis were written after the publication of Tarski's paper (Tarski 1933), when semantic concepts became admissible. At the time, Ajdukiewicz thought that to defend conventionalism against an idealistic interpretation was enough to demonstrate the existence of truths that were not theses.

Later on, he came to the conclusion that in order to do this, it was also necessary to demonstrate the existence of false theses.

In the second point, I would like to give an answer to the question about the relation of extensions of the notions of truth and thesis in radical conventionalism and whether it is really necessary to demonstrate the existence of false theses and truths that are not theses, in order to avoid the interpretation of conventionalism in the spirit of idealism — idealism as perceived by Ajdukiewicz himself.

2. The relation between extensions of the notions of truth and thesis versus the issue of idealism.

2.1. Is each thesis true?

If the analysed theses were theses of a semantically uninterpreted language, then assessing their logical value would not be possible. Postulating the coextensiveness of an uninterpreted thesis and of truth or even just the subordination of the extension of thesis to the extension of truth, could in fact lead to idealism in Ajdukiewicz's understanding. My subsequent considerations will be devoted exclusively to interpreted languages.

2.1.1. Empirical theses

I propose the following definition of the notion of an empirical thesis of a language: a sentence S is an empirical thesis of language L , if and only if, there exists such a user x of language L and there exists such conditions y that x is in conditions y and the rules of language L demand that anyone who is in conditions y assert the sentence S .

Ajdukiewicz's texts do not indicate unequivocally how we should understand those conditions y , and in particular, whether those conditions come down to certain experiential data or whether they also include a certain objective situation as the source of those experiences. The general description of the notion of an empirical thesis rather suggests the first interpretation: an empirical thesis is a sentence determined by a meaning-rule in the face of certain perceptual data. However, specific examples of empirical theses or meaning-rules suggest something else. They are formulated in the following way: one cannot refuse to assert the sentence 'this is white' when one is pointing to snow that is normally seen and illuminated but not when one is experiencing the sensation of snow or experiencing experiential data indicating the presence of snow. Or: one cannot refuse to accept the sentence

'it hurts' when one's naked tooth nerve was touched in an indelicate way but not when one experiences a toothache. Let us investigate whether on the basis of either of those interpretations — the objective one or the perceptual one — empirical theses can exist that are not true sentences.

This distinction is present in Ajdukiewicz as the notions of simple and compound empirical meaning-rules, which we have mentioned earlier. However, he derives no consequences from it, only expressing the view that the empirical meaning-rules operating in natural language are not simple rules. This probably has to do with Ajdukiewicz's realism and his commonsense attitude towards philosophical issues.

In the case of objective interpretation, the necessary and sufficient condition for a sentence to be an empirical thesis is: 1. the occurrence of a certain objective state of affairs where a rule relates to the acceptance of that sentence; 2. the registering of relevant experiential data about this state of affairs by a user of the language. It is also a sufficient condition for our sentence to be true, but not a necessary one. More precisely, the second part of this condition is not necessary. According to the classical conception of truth, the first part is sufficient for our sentence to be true. If condition no. 1 is satisfied but condition no. 2 is not satisfied by any user of that language, then our sentence is true but is not a thesis.

I think that under the assumption of an objective interpretation of the notion of empirical thesis, the language turns out to be interpreted in a semantic sense. This is because we should take note that empirical theses include all ostensive definitions, which constitute the direct, nonverbal interpretation of the language. For instance, pointing to a cat, one cannot refuse asserting the sentence 'this is a cat.' The indirect, verbal interpretation occurs through meaning-relations (expressed in deductive and axiomatic meaning-rules) between directly interpreted terms and other terms. Empirical theses that are not ostensive definitions indicate, in an approximate manner, the interpretation of a language through examples of using the language correctly in the face of certain facts.

Under such an interpretation of empirical theses, the language turns out to be interpreted semantically, and each empirical thesis is a truth but not each truth is a thesis. Such a perspective does not imply an idealism in the sense of reducing the concept of truth to syntactic concepts. The conception of language from the period of radical conventionalism did not involve any semantic concepts. This may seem to imply that the language is uninterpreted in the semantic sense, and so ~~that~~ being a thesis in that language is no guarantee of truth. However, such an impression would

be false: actually, such a language can be interpreted semantically, and this interpretation is based on empirical theses, which for this reason are guaranteed to be true.

Such an interpretation of empirical theses, based on objectivity rather than perception, is nevertheless seriously defective: in the case of sensory illusions, which obviously cannot be avoided, certain sentences can be erroneously taken to be theses. Linguistic measures with experiential data may prove insufficient for identifying the theses of the language, which seems an undesirable outcome, since it is inconsistent with the concept of a thesis. This happens when we cannot refuse to assert a certain sentence in view of empirical data and the conviction about the normalcy of the situation, while the conviction is actually false. The sentence is then mistakenly asserted as a thesis, because the necessary conditions have not been met for it to be an objectively interpreted thesis.

In the case of a perceptual interpretation, for a sentence to be an empirical thesis the language user has to experience empirical data, in the face of which an appropriate meaning-rule prohibits the rejection of this sentence. For such a language to have its objective references — and as I have mentioned, my intention here is to investigate only semantically interpreted languages — it is necessary to make a provision, which in my opinion is in accord with Ajdukiewicz's suggestions, that the source of empirical data is a reality transcendent to our consciousness. As a consequence of this provision, false theses may appear in the language. Their assertion results from empirical meaning-rules in the face of illusive empirical data that do not give adequate information about reality. There is a place in such a language for the classical conception of truth, though employing it properly is difficult. We can infallibly identify theses but not truths, because the rules for asserting sentences, which we use in practice, lead to the assertion of theses, not truths.

What does this interpretation of the concept of empirical thesis say about the issue of idealism? Empirical theses are not *ex definitione* true in the classical sense. Therefore, if someone using the notion of empirical thesis in the perceptual sense held that each empirical thesis is true just because of being a thesis, this would be evidence that the person was not using the classical conception of truth but a different one. This would situate the person close to the idealism in Ajdukiewicz's interpretation. In order to avoid the charge that he himself represented this type of idealism, Ajdukiewicz maintained that not every thesis (including an empirical one) is true. This statement is indeed necessary to avoid such a charge if one is grounded

in the perceptual interpretation of the notion of empirical thesis. Not so, however, if one is grounded in the objective interpretation, since then each empirical thesis is *ex definitione* true in the classical sense. Therefore, the assertion that each objectively interpreted empirical thesis is true, by no means indicates a departure from the classical conception of truth. So in order to avoid the charge of idealism, Ajdukiewicz could have either pointed to the existence of false empirical theses or interpreted objectively the notion of an empirical thesis. He took advantage only of the first possibility.

And so, we have the two possible ways of interpreting empirical theses: the objective one and the perceptual one. In the first one, each thesis is true and an idealistic interpretation of that view is not possible, but linguistic measures together with experiential data do not guarantee a faultless identification of theses. In the second one, there is a place for theses not being true sentences in the classical sense, and so the view that each thesis is true is a departure from the classical conception of truth, while linguistic measures allow — in view of experiential data — proper identification of theses. We have a choice between the two, depending on which notion of empirical thesis seems more useful: empirical thesis as a true sentence in the light of the meanings of terms and certain facts (but because of sensory illusions it is sometimes possible to mistakenly take certain sentences for theses) or empirical thesis as a sentence we cannot reject in the light of experiential data and the meanings of terms, even though it may not be true. Before making a choice, however, it is worth considering whether making a choice is necessary. Could we retain from each of those notions what seems useful and discard what is inconvenient, thereby finally constructing the notion of empirical thesis?

As I have already mentioned, some parts of Ajdukiewicz's texts seem to favour the first of those interpretations, and other ones — the latter (Ajdukiewicz 1978: 46, 68, 40). It is difficult to imagine that he would be so inconsistent. It seems much more probable that for him there was no difference between the two interpretations, because he assumed the world of perceptions and the world of things were homomorphic. Then the circumstances, in view of which one cannot refuse to assert a given sentence by virtue of a rule, boil down to certain objectively existing facts that are the source of experiential data, providing we always know when the data are giving us adequate information about reality, and the assumption about the normalcy of the situation is never false. Then the language is interpreted objectively and each thesis is true, but there is nothing idealistic about it — like in objective interpretation; and at the same time, linguistic measures

and experiential data are sufficient for accurate identification of theses — like in perceptual interpretation. On the other hand, there is no room here for errors, and this is a certain defect that Jan Vetulani (Vetulani 1965: 18-19) imputes to Ajdukiewicz, saying that Ajdukiewicz has not demonstrated the homomorphism of the world of perceptions and the world of things. Since this is something extremely difficult or even impossible to prove, the conception we are discussing would be untenable unless we assumed it to be an idealisation. If we wanted to make a concretization of this conception and take into account the issue of illusive experiential data, we would have to choose one of the two interpretations presented earlier. When we observe how Ajdukiewicz defended himself against the charge of idealism, it seems he chose the perceptual interpretation.

2.1.2. Axioms

In response to Schaff's critique (Schaff 1952), and more specifically the charge that, as it seems, each thesis is guaranteed to be true simply because it is a thesis, Ajdukiewicz writes: "It is only with far-reaching reservations that I am now ready to support the assertion which considers true each sentence dictated by some axiomatic rule" (Ajdukiewicz 1965: 161). I think that those reservations are supposed to refer to the sentences to which Ajdukiewicz devoted the article "The Problem of the Foundation of Analytic Sentences" (Ajdukiewicz 1978: 254-268). In that article, Ajdukiewicz defines the notion of an analytic sentence and then shows that validating analytic sentences very often requires one to resort to experience. Quoting from Ajdukiewicz himself, here are the definitions of the basic notions from that article:

A sentence S is a postulate of the language L if in L there is a terminological convention which determines that a term λ occurring in S is to denote an object which satisfies S in the place of λ .

A sentence S is analytic in the language L in the semantic sense if it is a postulate of L or a logical consequence of the postulates of L .

A sentence S is analytic in L in the syntactical sense if it is a logical truth in L or reduces to a logical truth in virtue of syntactical terminological conventions of L . (Ajdukiewicz 1978: 255-256)

Further on, Ajdukiewicz writes:

... the terminological convention to the effect that a term λ is to denote an object satisfying the condition $F(\lambda)$, on its own does not guarantee the truth of the sentence $F(\lambda)$ in the language in which the convention has been adopted. Such a guarantee is given only by the convention in conjunction with the existential premiss $\exists xF(x)$. (Ajdukiewicz 1978: 259)

The decision to have a term designated to such and such an object is not sufficient, according to Ajdukiewicz, for the term in question to actually be designated to it, since the object may not exist. If we forget about this, then based on the convention that the term 'Polyphemus' designates an object satisfying the condition 'Polyphemus is a man 100 m tall,' we may assert that in fact Polyphemus is a man 100 m tall and so, in virtue of the law of logic $F(a) \rightarrow \exists xF(x)$, infers that there exists a man 100 m tall. Therefore, it turns out that analytic sentences may have empirical consequences. Hence, the truth of analytic sentences is guaranteed not by the terminological conventions alone but by terminological conventions in conjunction with the truth of empirical consequences of analytic sentences.

Neither do analytic sentences in the syntactical sense owe the guarantee of their truth only to terminological conventions. This is because those conventions are rules of translation that are used for deriving some sentences from other ones. The rules alone are not sufficient for validating any sentence: we also need premisses, from which that sentence can be derived in virtue of those rules.

In particular, it is important that we are not allowed to pass from a universal sentence $\forall xF(x)$ to its substitution $F(a)$ before we make sure that a exists. Otherwise, in the expression $\forall x(x = x)$, we could substitute for x : 'a man 100 m tall,' and then in virtue of the syntactical terminological convention allowing the interchangeable use of the expressions 'Polyphemus' and 'a man 100 m tall' we could claim that Polyphemus is a man 100 m tall — a sentence, as demonstrated earlier, with a false existential consequence, hence itself false. An existential premiss is therefore necessary when substituting a law of logic. Only the laws of logic themselves do not require for their validation any existential premisses.

The views presented in the article in question may seem highly controversial, therefore it is natural that they gave rise to many commentaries, counterproposals and polemics. We may roughly divide their authors into two categories. One consists of those for whom the point of departure is the analysis of natural language and for whom Ajdukiewicz's reasoning may seem erroneous. The other one consists of those who are grounded in the classical definition of truth from the model-theoretic perspective and who

do not question that reasoning but claim Ajdukiewicz's notion of analyticity is too wide and suggest it should be narrowed down to only those sentences whose verification can make do without experience.

Authors from the first category think that in natural language, not all sentences with empty designations have to be false. Izydora Dąmbska writes the following in her 1948 article, so not in reference to Ajdukiewicz's views, nevertheless expressing a thought one might have after reading Ajdukiewicz:

The statement 'Erato is a Muse' is true; 'Erato is one of the Fates' is false; 'Zeus was a deity in Greek mythology' is true; and 'Zeus was a deity in Chinese mythology' is false. . . . to questions about who Erato and Atropos were, I can give the true answer: Erato was a Muse, and Atropos was one of the Fates, even though supposedly neither the Muses nor the Fates exist. Something is wrong here. Am I to say that Erato is nothing and Atropos is nothing since they do not exist in the same sense in which chairs and horses exist, for allegedly only the last-named entities may be said to 'be this or that' when the copula is understood in its primary sense. But why only these entities? (Dąmbska 1979: 127)

Indeed, the rules of natural language, especially those that govern the use of the word 'true,' allow us to assert as true the sentences 'Zeus is an Olympian god' or 'Pegasus is a winged horse' and as false the sentences 'Zeus is a nymph' or 'Pegasus is a winged cow.' Sentences that predicate about intentional entities such properties in relation to which those entities are underdetermined (e.g. 'Madame Bovary is 160 cm tall') could be considered, according to Ingarden's proposal (Ingarden 1973: 142-143), lacking any logical value.

An ordinary user of natural language, unaware of the laws of logic or the scope of their application but aware of the meanings of expressions and the rules used in the language for accepting sentences, probably would not agree with the view that if one asserts the sentence 'Polyphemus is a man a 100 m tall,' one cannot refuse to assert the sentence 'There exists a man 100 m tall.' Such a person would be ready to assert the sentence 'Zeus is an Olympian god' but would reject the sentence 'Olympian gods exist' — hence the latter one could not be considered the consequence of the first one.

Zbigniew Czerwiński claims (Czerwiński 1964) that the law of logic $F(a) \rightarrow \exists x F(x)$ which Ajdukiewicz invokes in his reasoning when he postulates that a man 100 m tall exists if Polyphemus is a man 100 m tall, is taken from Russell's symbolic language in which individual constants symbolize objects whose existence is taken for granted. The example with the non-existing Polyphemus is not a substitution of this law. It can be used

correctly on the condition that the object designated by *a* exists. When the designation of *a*, i.e. the designation of the term whose meaning is constituted by a postulate, does not exist, then one cannot employ this law properly. From this definition of a gram: 'a gram is the mass of any cubic centimeter of water,' one cannot infer that each cubic centimeter of water has the same mass; one can only surmise that, following the conjecture that if the class of all cubic centimeters of water with the same mass did not exist, no one would establish this definition, which in that case would be completely useless but would not implicate any false empirical consequences.

Urszula Niklas follows a similar line of thought when she writes:

... common language is ontologically neutral. It means that in this language, real predication about anything does not lead to the assertion of existence of the object in question. In other words, this is a language without any existential assumptions, in the sense that using a certain individual name does not involve the assumption about the existence of the bearer of the name, as it happens in constructed languages. ... [Natural language] allows us to claim or negate the existence of individuals; one of the reasons this is possible is that in contradistinction to languages grounded in first-order logic, in ordinary speech the word 'exists' is a predicate. ... in common language, the logical value of such sentences is not predetermined by the fact of the nonexistence of the bearer of the empty name but is defined by a certain cultural tradition the language operates in. (Niklas 1979: 207-208)

Urszula Niklas formulates the truth-conditions for sentences with empty individual names. They are different from truth-conditions for empirical sentences. She calls the sentences that in an arbitrary or customary way determine the meanings of empty individual names occurring in them: meaning postulates for those names. Among the sentences containing names of this type, it is the meaning postulates for empty names and their logical consequences that are supposed to be true. The sentence 'Madame Bovary was a woman' satisfies the presented truth-conditions but the sentence 'Madame Bovary was 160 cm tall' does not.

Like Czerwiński, Urszula Niklas claims Ajdukiewicz's notion of meaning postulate was formulated exclusively for non-empty names, hence in her opinion, Ajdukiewicz's article "The Problem of the Foundation of Analytic Sentences" and her own article treat different issues.

Adam Nowaczyk concurs that the rules of natural language require that we accept as true certain sentences with empty individual names, but he feels this does not put in question the soundness of Ajdukiewicz's reasoning. For Nowaczyk, like for Urszula Niklas, the truth of sentences with

empty individual names differs from the truth of purely empirical sentences. According to the rules of natural language we can therefore consider the sentence 'Polyphemus is a cyclops' true, though this is not truth in a classical sense. According to the classical definition of truth as explicated in model theory, a sentence is true in a given language when what it claims is satisfied in the proper model of that language. Since the notion of truth here is relativised to the proper model of the language, it can only be used for sentences interpreted in the semantic sense, i.e. for sentences of a language that has a proper model. Languages with empty individual names are not fully interpreted semantically. Nowaczyk writes: "Now if we say that some terms in L denote nothing, then we cannot speak about a proper model of L . Hence a phrase 'a statement which is true in L ' is meaningless in such a situation." (Nowaczyk 1979: 475)

As we can see, Nowaczyk is grounded in the classical definition of truth as explicated in model theory, and from that perspective, he pronounces the notion of truth that functions slightly differently as to be "meaningless," because it lacks a certain relativisation necessary for making use of the model-theoretic notion of truth. From that point of view, Ajdukiewicz's reasoning is by all means valid, and the fact that a user of natural language might consider the sentence 'Polyphemus is a cyclops' true and the sentence 'cyclopes exist' false, is of marginal significance, since in natural language, the notion of truth sometimes (and that is the case here) lacks meaning, according to the presented approach.

Piotr Brykczyński has a similar view and criticises Czerwiński's reasoning, according to which the law of logic $F(a) \rightarrow \exists xF(x)$ only holds in languages that do not contain empty individual names. Brykczyński writes: "This reasoning seems erroneous. The law in question does not require for its validity the existence of an object designated by a , because it is an implication, and an implication can be true even though the consequent is false" (Brykczyński 1979: 34).

Indeed, Brykczyński is right, but only when we use exclusively use the model-theoretical notion of truth, which does not quite correspond to the notion of truth that functions in natural language. Then it is indeed not possible for $F(a)$ to be true and $\exists xF(x)$ to be false at the same time. Here, the necessary condition for the truth of the sentence $F(a)$ is the existence of the object designated by a . What remains is to decide whether this condition is also the necessary condition for the meaningfulness of this sentence. Can one falsely but meaningfully assert $F(a)$ when a does not designate anything?

This is what Nowaczyk writes:

If L has bound variables of the same type as λ , and if such rules of inference as the rule of substitution and the rule of existential generalization do hold in L , then λ cannot be a meaningful expression in L . This is the conclusion arrived at by Marian Przełęcki, who points to the fact that in such languages the statement $\exists x(x = \lambda)$ is a logical tautology. Hence its metalinguistic analogue $\exists x(\lambda \text{ denotes } x)$ should be true, which contradicts the assumption that λ denotes no object. Now, if λ is not a meaningful expression in L , then $\varphi(\lambda)$ is not meaningful in L , either. If it is not a meaningful expression in L , $\varphi(\lambda)$ cannot be a true statement in L . Yet, if L does not satisfy the description given above, then the conclusion that the term λ , which does not denote anything, is not a meaningful expression in L , does not impose itself irresistibly. (Nowaczyk 1979: 474)

This is actually the situation we encounter in natural language. Natural language tends to be universal, which manifests in such ways as the possibility of talking meaningfully about something that does not exist, or the possibility to predicate the existence or nonexistence of individuals, instead of making out of the existence of designations of expressions the necessary conditions for meaningful use of those expressions. This tendency of natural language towards universality is the reason of known ambiguities and problems, and we can probably assume that the problem of logical value of meaning postulates for empty names is one of them.

And so, in the languages described by Nowaczyk (which are the languages usually considered in model theory) empty names and expressions comprising those names are meaningless, while in natural language these expressions can be meaningful and even true, if we use the notion of a true sentence according to the rules of natural language. This is because in natural language the formula $\exists x(x = \lambda)$ is not a tautology and the rule of existential generalization does not hold. It is this very rule that Ajdukiewicz referred to in order to demonstrate the falseness of postulates with empty names, and Nowaczyk — in order to demonstrate, based on Przełęcki's reasoning, that empty names are meaningless. Revoking this rule makes it impossible to demonstrate both the meaninglessness and falsity of all sentences with empty names; they can be both meaningful and true, though no more in the model-theoretical sense of the notion of truth that usually goes hand in hand with the rule of existential generalization.

However, a language could be possible, in which truth would be defined in the model-theoretical sense and which would not conform to the description given by Nowaczyk. Then, and only then, sentences with empty

names could be considered meaningful but false, though their falsity could not be demonstrated by reference to the law of logic $F(a) \rightarrow \exists xF(x)$.

To some extent, Maria Kokoszyńska's (Kokoszyńska 1962: 1964) views converge with the above reasoning. Like Ajdukiewicz, she classifies meaning postulates and their consequences as analytic sentences but she precludes the possibility of their falsity. However, when the postulates are creative, i.e. when they have empirical consequences, it may happen that these consequences are not satisfied in a proper model, and so those postulates cannot be satisfied in a proper model enlarged by the designations of new terms. In that case, we do not assume that the postulates can be false and need empirical verification but that there is no proper model of the language enriched by meaning postulates which themselves cannot be false. Then a semantical system consisting of the language and its interpretations does not exist. The assumption is that a language ought to talk about something, so only expressions of an interpreted language are meaningful. Therefore, meaning postulates with consequences that are not satisfied in the proper model of the language before enriching it here by postulates, turn out to be meaningless, because the language enriched by such postulates lacks an interpretation. In particular, this refers to meaning postulates for empty names.

Analytic sentences, i.e. meaning postulates and their consequences, can be either true or meaningless. They do not satisfy the model-theoretic criterion of truth, i.e. they are not satisfied in a proper model, only when they do not satisfy the criterion of meaningfulness, which is more general than the criterion of truth, that is, when a proper model does not exist. With the notion of an analytic sentence as wide as Ajdukiewicz's, experience does not decide any more about the potential falsity of those sentences but it does decide about their meaningfulness, since it is the experience that determines whether there exists a proper model of the language, in which those sentences are expressed. Hence, even if we use only the model-theoretical notion of truth, it is not necessary to assume the possibility of existence of false meaning postulates in the language, if we only consider meaningless the postulates that do not satisfy the model-theoretic criterion of truth.

Another way to preclude the possibility of false analytic sentences occurring in the language is to restrict the notion of analyticity. In the view of Przełęcki and Wójcicki, the term 'analytic' should be reserved for sentences whose verification can dispense with experience, since it is this notion of analyticity that has been handed down to us by philosophical

tradition, that is suggested by linguistic intuition and ~~that is~~ significant from the methodological perspective (Przełęcki 1963; Przełęcki, Wójcicki 1969; Wójcicki 1963). Since Ajdukiewicz demonstrated that meaning postulates might have false empirical consequences, it is not good to classify those postulates without any qualification as analytic sentences, as had been done traditionally and as Ajdukiewicz did himself. For such an approach, it is necessary to construct a new definition of an analytic sentence.

We can do this in various ways. For instance, we can assume that we classify meaning postulates and their logical consequences as analytic sentences but only under the condition that the truth of those postulates is guaranteed by the existence of such a proper model of the language enlarged by postulates, in which those postulates are satisfied and which leaves unchanged the interpretation of terms belonging to the language before its enlargement by postulates.

There is also another possibility. If the set of postulates is creative with respect to the language it is introduced into, then it fulfils a dual function: it constitutes the meaning of new terms and it comprises certain empirical content that can be expressed without resorting to those new terms. By virtue of this, within the set of postulates we could distinguish an analytic component and a semantic component. When they are adequately distinguished, the analytic component should give to the new terms exactly the same meaning as the meaning postulates and should not contain any factual content, while the synthetic component should contain the same factual content as the meaning postulates and should not impose any conditions on the manner of interpretation of the terms characterised by those postulates. We should classify them as analytic sentences not the totality of meaning postulates with their consequences, but only the analytic components of meaning postulates and the consequences of those components. Analytic sentences defined according to this suggestion could not have any empirical consequences. However, it turns out that whereas distinguishing a synthetic component should be done unequivocally, distinguishing an analytic component satisfying the aforementioned conditions is possible in a number of ways. This introduces an element of convention when we unequivocally define the notion of the scope of an analytic sentence.

Since meaning postulates can be creative with respect to the language into which they have been introduced, it turns out to be impossible to remain in accord with philosophical tradition, which on the one hand classifies all meaning postulates and their consequences as analytic sentences, and on the other hand identifies analytic sentences with true sentences only by virtue of

the meanings of expressions. The existence of creative meaning postulates has therefore given rise to the necessity of coming up with a new, consistent definition of analyticity. Relevant proposals have been signalised above.

I would like to present a view here that due to the necessity of obtaining a more precise notion of analyticity, a special position among the creative meaning postulates of natural language is taken up by those postulates whose empirical consequences are exclusively existential sentences. This is because in natural language, when consequences of meaning postulates prove false, we have differing situations depending on whether they are existential consequences or general ones. Let us illustrate the first case with an example:

the postulate

$$F(a)$$

has a false empirical consequence

$$\exists x F(x),$$

and the second case with another example:

a pair of postulates

$$\forall x [F(x) \rightarrow G(x)]$$

$$\forall x [G(x) \rightarrow \sim H(x)]$$

has a false empirical consequence

$$\forall x [F(x) \rightarrow \sim H(x)]$$

Now, in the second case, after demonstrating the falsity of the consequences of postulates, it is natural and commonplace to stop using the term *G*, characterised by those postulates, and to revoke the binding power of the conjunction of those postulates in the language. This binding power is abandoned as false or meaningless.

On the other hand, such a situation does not always occur in the first case. In natural language, do not meaning postulates that talk about Olympian gods and cyclopes, even though we know that neither Olympian

gods nor Cyclopes exist, hold? This happens because of the aforementioned tendency of natural language towards universality, expressing itself, for instance, as the need to also be able to talk about nonexistent things. And in order to be able to use the names of any objects, also nonexistent ones, we first have to characterise them — either by ostension, which is not possible in the case of empty names, or through postulates. However, declaring such postulates meaningless or false in the model-theoretic sense is not necessary, since nothing in the notion of a model implies that models exist only in an empirical sense.

Let us take the example of how the notion of existence functions in mathematical theories, where existence means either consistency, according to Poincaré (Poincaré 1914: 132, 152), or additionally being an element of a certain domain, according to Ajdukiewicz (Ajdukiewicz 1920). The universe of the natural number theory model certainly does not exist in the way Ajdukiewicz wanted Polyphemus to exist so that we could really predicate anything about him. Nothing prevents us from using the notion of a model in such a way as to include in it not only mathematical or empirical objects but also objects that do not exist empirically but only intentionally. For the sake of brevity, I am henceforth going to write about intentional existence and about intentional objects in contradistinction to empirical ones. While this approach makes no contribution with regards to the linguistic analysis of mathematical or empirical theories, this is the kind of approach required in natural language. Even though large parts of it, for instance Greek mythology, are not interpreted in an empirical sense, it seems controversial to conclude that they have no interpretation whatsoever and express nothing. They do have intentionally existing models.

The model-theoretic conception of truth, relativised only to empirical proper models, is not coextensive with the conception of truth functioning in natural language — it is narrower. This can be avoided by relativising the model-theoretical notion of truth also to intentional models, if they are proper ones. The sentence 'Zeus is an Olympian god' would therefore be true, because it holds in the intentionally existing model of the language of Greek mythology.

Natural language is a conglomerate of various languages, each one of which has its proper model. There may be various modes of existence of those models: empirical, intentional, or perhaps a different one still. I think that only then would it be permissible to relativise the notion of truth to an intentional proper model of a certain sublanguage of the natural language, if the totality of broadly defined meaning postulates indicated

that the model of that sublanguage existed intentionally (this is actually the case with mythology). Otherwise, if the intentionality of the existence of a proper model was not something obvious, one could draw false empirical consequences from sentences satisfied in such a proper model. For instance, someone with an incomplete knowledge of the meaning postulates of natural language, thinking that the model of the language of Greek mythology existed empirically and that therefore the true sentence 'Polyphemus is a cyclops' of that language was satisfied in an empirical model, could derive from that sentence the consequences that cyclopes existed (in an empirical sense).

Precluding, in the case of natural language, the possibility of relativising the notion of truth to the intentionally existing proper models would implicate a certain unacceptable consequence: namely, in view of the tendency of that language towards universality, some meaning postulates for empty names, considered by the users of that language either false or meaningless, would retain their validity in that language.

Of course, the proposal I have presented does not refer to those meaning postulates that have general consequences unsatisfied in proper models and to the postulates with existential consequences unsatisfied in empirical proper models. It may always turn out that certain meaning postulates we have introduced into the language do have such consequences. Whether that proves the possibility of false axioms appearing in the language, depends on whether we assert those postulates as false and at the same time belonging to the set of axioms, or we exclude them from the set of axioms by way of considering them meaningless or by way of restricting the notion of axiom — in the same way we have done with the notion of an analytic sentence. In the first case, the axioms of the language could be false; in the second case, they could not.

Deciding on the second of those solutions, we rule out the possibility of false axiomatic theses appearing in the language, but this does not implicate a tendency towards idealism, i.e. the rejection of the classical definition of truth. By definition, each axiom of the language is true in the classical sense, and so the assertion that all axioms are true does not violate the classical definition of truth. Even though it may happen that an expression intended as a postulate of the language turns out to be meaningless and so cannot be a postulate, this does not affect the problem of the logical value of the postulates that are axioms of the language.

If, however, someone rejected that solution, i.e. did not want to exclude from the set of axioms the postulates with consequences unsatisfied

in the proper model, and at the same time asserted that each meaning postulate and each axiom were true, such a person would thereby prove that he or she does not use the notion of truth in a classical sense.

Numerous examples prove that in a language, meaning postulates can exist that have consequences unsatisfied in the proper model. We can exclude those postulates from the set of axioms or leave them in it. With regard to this, the defence against the charge of idealism may take two forms: we can either indicate postulates that do not satisfy the classical criterion of truth, classify them as axioms and assert that the extension of the notion of axiom is not subordinate to the extension of the notion of truth, thus predicating the falsity of those postulates; or we can also classify as axioms only those postulates which are true in the classical sense.

Ajdukiewicz chose the first of those possibilities.

As far as the second possibility is concerned, it seems to me that the postulates with consequences unsatisfied in the proper model can be validly excluded from the set of axioms only by way of asserting that those postulates are meaningless and not by way of restricting the notion of axiom, as was the case with the notion of the analytic sentence. In my view, we are not entitled to such a restriction as long as we are grounded in the directive conception of meaning. In this conception, the word 'axiom' has a clearly defined meaning that is a vital element of this conception. Therefore, it is not possible to change the extension of the notion of axiom with the aim of excluding false postulates from that extension, and to do it by way of restricting the notion itself. On the other hand, asserting as meaningless the expressions that were meant to be postulates but their consequences turned out to be unsatisfied in the proper model, we have to agree that even though experience does not determine the logical value of postulates, it does determine the extension of the name 'postulate.'

2.1.3. Theses accepted by way of deduction

We can reduce each deductive rule of meaning to a certain axiom in the form of an implication, e.g. the rule "no one speaking English and asserting the sentence 'John is older than Peter' can refuse to assert the sentence 'Peter is younger than John'" is based on an axiom of the English language: "If John is older than Peter, then Peter is younger than John." Therefore, whether deductive rules of meaning can be a source of false theses depends on the possibility of the axioms of the language being false (this problem was discussed in the previous point), since those deductive rules of meaning which

are based on false axioms are fallible. Employing those rules for deduction may lead to formal mistakes.

The possibility of the occurrence in language of false theses that have been asserted by way of deduction is determined by another factor — the existence of false empirical theses in that language (this problem was discussed in point 2.1.1.). This is because even though deductive rules of meaning are infallible in virtue of the truth of all the axioms of the language, using those rules may still lead to false theses if at least some premisses are false theses themselves. Employing the rules of meaning for deduction may lead to material mistakes.

Hence, if there are no false empirical or axiomatic theses in the language, then employing deductive rules of meaning cannot be the source of false theses; however, if there are false empirical or axiomatic theses in the language, then employing deductive rules of meaning can expand the set of false theses.

2.1.4. Truth of theses versus idealism

We have completed discussing the problem of whether each thesis is true. The discussion has shown that the issue of the existence of false theses is not unequivocal.

The empirical theses of a language can be false under the assumption of a perceptual interpretation of the notion of empirical thesis, but not so under the assumption of an objective interpretation.

The possibility of axioms being false depends on whether we assert the meaning postulates with consequences unsatisfied in the proper model as false or as meaningless and also on whether we restrict the notion of axiom.

Employing deductive rules of meaning has no significant impact on the presence of false theses in the language.

Thus, for one kind of solution to certain, quite detailed problems it is not possible for false theses to occur in a language, whereas it is possible for another kind of solution with the same problems. The solutions of the first kind go hand in hand with the guarantee of theses being *ex definitione* true in the classical sense, while solutions of the second kind give no such guarantee. Therefore, if someone grounded in the solutions of the second kind asserted that each thesis is true in virtue of it being a thesis, this would be evidence that the person was not using the classical notion of truth. Demonstrating the existence of false theses when grounded in the solutions of the second kind is therefore a defence against idealism understood as the abandonment of the classical definition of truth. An alternative defence is to

adopt the solutions of the first kind, on the grounds of which the assertion about each thesis being true is not treated as evidence of abandoning the classical notion of truth.

Ajdukiewicz noticed only the first possibility of defence against idealism but did not see the second one. Contrary to his conviction, if one adopts the solutions of the first kind, one may assert that each thesis is true without concern about transforming conventionalism into idealism.

2.2. Is each truth a thesis?

The existence of sentences that are true in the classical sense but are not theses of a given language seems an unquestionable fact. These include true hypotheses and generalizations; other true sentences that, in view of the lack of appropriate experiential data, we can refuse to assert when speaking a given language; and true sentences that are not even sentences of that language. Therefore, if anyone claimed that each true sentence is *ex definitione* a thesis of a given language, this would be evidence that the person was not using the classical notion of truth. Restricting the notion of truth by excluding all unidentified truths would in fact be an abandonment of the classical definition of truth and would tend towards idealism in Ajdukiewicz's understanding. On the other hand, it would be difficult to enlarge the notion of thesis to make it include the totality of sentences true in the classical sense, as well as those unidentified as truths. However, the existence of truths that are not theses is not indicated by any logical necessity but only by an objective one.

It seems Ajdukiewicz had a different view (Ajdukiewicz 1978: 140-153). He maintained that in incomplete languages, i.e. all languages that are rich enough including natural language, there are problems that are not decidable either empirically or *a priori*. In such languages there are pairs of contradictory sentences, such that by virtue of the law of excluded middle, one of them has to be true, even though none of them is a thesis. He gives the following example: the meaning of the neologism 'abra' is defined by two postulates — 'Adam is an abra' and 'each abra is a human.' Out of the two sentences: 'Eve is an abra' and 'Eve is not an abra,' neither are a thesis, even though one of them has to be true. Admittedly, in such a situation, Ajdukiewicz does provide for the possibility of giving up the law of excluded middle but he does not treat that possibility seriously.

Yet one hears sometimes that the law of excluded middle often does not hold when the meaning of terms is underdetermined. For instance, this

is the case with intentional objects, as Ingarden holds (Ingarden 1973: 142-143) and Marciszewski suggests (Marciszewski 1980, 36). Marian Przełęcki claims that this actually is the case with vague terms (Przełęcki 1973). In a paper presented at the 27th Conference on the History of Logic, Przełęcki expressed his opinion that in languages with vague terms, the metalogical law of excluded middle loses its validity, while the logical law retains it, if one assumes there is a possibility of arbitrary precisification of vague predicates. In the example given by Ajdukiewicz, the logical law of excluded middle would have the form: however one precisifies the predicate 'abra,' Eve is an abra or Eve is not an abra — and this law would hold, whereas the following metalogical law would not hold any more: however one precisifies the predicate 'abra,' the sentence 'Eve is an abra' is true, or however one precisifies the predicate 'abra,' the sentence 'Eve is an abra' is false.

Thirty years later

First of all, two brief complementary remarks. In the above text, the perceptive reader may be intrigued by the chronology. Ajdukiewicz's main papers on radical conventionalism, which avoided references to semantics in order to avoid antinomies, appeared in 1934, while Tarski's aforementioned paper, which safeguards semantics against antinomies, appeared earlier, in 1933. However, the wider impact of Tarski's paper was not immediate, hence Ajdukiewicz's initial semantic restraint, noticeable in his radical conventionalism but abandoned soon after.

The second remark concerns the further history of the directive conception of meaning after Ajdukiewicz relinquished radical conventionalism. The conception remained valid (as we can read in this paper) but in a weakened version (and this remained beyond the scope of the paper). In response to Tarski's critique, Ajdukiewicz acknowledged that even though all synonymous expressions are mutually exchangeable within the rules of meaning, the converse does not hold, since exchangeable expressions are not always synonymous. Thus, only the necessary condition was retained from the necessary and sufficient condition of synonymy.

Let us proceed to more important matters. Whereas the considerations involving the relationship of the extensions of truth and thesis do not require any commentary, placing this issue in the context of the problem of idealism does. Did not Ajdukiewicz address this issue for the very purpose of refuting an idealistic interpretation of radical conventionalism?

For a false thesis to occur two things have to coincide: such an explication of a thesis which gives this notion a meaning weaker than other possible ones

(an empirical thesis that is perceptual, not objective; axioms with empirical consequences) and certain deficiencies of cognitive measures (sensory illusions; defects in fashioning the cognitive tool of language, which result from ignoring synthetic components in sentences intended as meaning postulates). To accuse a philosopher of idealism in Ajdukiewicz's interpretation, it is also necessary for the philosopher to classify a thesis that is at odds with reality as true for the sole reason that it is a thesis. Hence, to avoid the possible charge of idealism, the philosopher should refrain from asserting that theses which are false in the classical sense are true by virtue of the definition of thesis alone (which would mean their truth in the non-classical sense). Towards this goal, the philosopher may do one of the following: 1. Admit that theses at odds with reality are false; 2. Evade the issue by not saying anything about the truth value of such theses; 3. Prevent the possibility of the occurrence of false theses by: (a) strengthening the notion of thesis in the way presented in this paper, thereby safeguarding theses against falsity, or (b) limiting the cognitive deficiencies that lead to false theses, for instance by way of impoverishing the language, thus limiting the field of research and thereby eliminating problematic situations.

The existence of truths that are not theses results from the undecidability of certain problems. The resulting cognitive limitations can be empirical of a technical nature, or empirical of an essential nature (lack of absolute observer, indeterminacy), or linguistic (when only defective meaning has been assigned to certain expressions).

By demonstrating the existence of false theses, Ajdukiewicz chose the first of the above approaches, and by demonstrating the existence of truths that are not theses, he focused on rich languages, in which undecidability is a fact. He was not explicit about it, but reading his texts, one gets the impression that he considered the non-coextensiveness of the notions of truth and thesis as the only way of avoiding the charge of idealism. However, this by no means is the case. It is sufficient to demonstrate that in terms of content, the notion of truth is not derived from the notion of thesis. In some poor languages, they can probably be coextensive. This is not evidence of idealism. Let us take note that the means of precluding the possibility of classifying false theses as true just because of them being theses, mentioned above in the points 3a and 3b, are at odds with Ajdukiewicz's idea: namely, they are actually meant to preclude the possibility of the occurrence of false theses.

In principle, we cannot rule out an accidental coextensiveness of the notions in question without abandoning the classical notion of truth.

However, more probable is a relationship converse to the one Ajdukiewicz considered essential for idealism: namely, in terms of content, it is the notion of thesis that is derived from the notion of truth. This is because the rules of language are devised to lead to the acceptance of sentences that enable desired, deliberate interaction with reality, i.e. to true sentences. It is therefore the classical notion of truth that shapes the set of theses and not an intralinguistic (syntactic) thesis that shapes the set of non-classical truths.

The non-coextensiveness of those notions is a result not of the falsity of idealism but (apart from the possibility of an excessively broad definition of thesis), first and foremost, of our cognitive deficiencies. These lead both to false theses and, in the face of empirical evidence, to the ungraspability of certain truths by means of rules of language. If we were to revive Laplace's demon, would this lead us in the direction of idealism? Because this is what Ajdukiewicz's reasoning seems to suggest. It seems that the predilection towards idealism may be served more by the undecidability of certain problems than their decidability. Ajdukiewicz's approach indicates the opposite.

His polemics with idealism shows he favours realism, however, as a position not opposed to idealism but to excessive cognitive optimism. Bringing up the essential undecidability of certain problems and empirical and linguistic cognitive traps curbs this optimism, but whether it also questions idealism — this probably depends on how one explicates the latter. Ajdukiewicz's interpretation of it is original but not the only one possible, and certainly very remote from the original conception of idealism.

This polemics with idealism led to valuable considerations on the part, firstly, of Ajdukiewicz himself, and later, his aforementioned continuators. Those studies included the analysis of the notion of thesis and of the relation between the extensions of truth and thesis, and they remain valid regardless of their original purpose. Even though they do not expressly refer to Quine, they are concerned with the problem of analyticity, which (along with mentalism) was supposed to be consigned to history by that philosopher. Quine tried to do that in one broad sweep, arguing from the behaviourist position that the notion of analyticity was completely vague and inapplicable. Polish philosophers presented a different approach, though like Quine, they were aware of the inadequacy of traditional views. On their part, they conducted painstaking investigations, aiming at the revision of the traditional notion of analyticity. Those investigations revealed that "the devil is in the details" but those details, based on linguistic introspection, were not of interest to Quine. In the face of the research by Polish philosophers, analyticity proves

to be (as Quine claimed) a vague notion, but this is not (contrary to Quine's claim) complete vagueness. Thus, they found themselves half way between tradition and its radical and one-sided critic.

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Jerzy Pelc

ON THE CONCEPT OF LIE – FROM THE POINT OF VIEW OF SEMIOTICS

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1 Introduction

Let us begin with a typical example of a lie. A husband coming back home several hours later than usual says to his wife: "I've been held up in the office by an important conference;" whereas in fact he spent this time with some pleasant company.

We are dealing here with a verbal communication act, i.e. people communicating with the use of language signs. The speaker utters a false sentence and knows that it is false; he utters it in order to mislead the recipient. The speaker is lying. The sentence he has said is a lie.

This simple example makes it possible to observe several things.

Firstly, we may distinguish an ACTION – LYING from its PRODUCT – i.e. A LIE.

Secondly, it is possible to note that a condition necessary for lying is to SEND some SIGN, and the lie is such a SIGN sent; there is no lying and no lie without a sender.

Thirdly, for the lying person to achieve her/his purpose the lie needs to have a RECIPIENT; otherwise it would not have any effect. A lie which has not been realized would be like counterfeit money which has not been put into circulation, and lying without a recipient is like manufacturing counterfeit money and not putting it on the market; it would have a supposed addressee but no actual recipient.

Fourthly, lying and lies appear in the course of communication, and in the case under discussion – in the course of language communication.

Thanks to its sign character they are a part of the process of SEMIOSIS, i.e. the process of using signs.

Fifthly, within this process, a SEMANTIC FEATURE of a lie, i.e. of a certain sign, and to be more precise of a given use of a sign in specific circumstances, is its FALSENESS. Further, the PRAGMATIC FEATURES of semiosis in this instance are (a) the fact that THE SENDER WISHES TO MISLEAD THE RECIPIENT, (b) the fact that the sender KNOWS THAT THE SIGN HE IS USING IS FALSE, (c) the fact that the recipient BELIEVES THAT THE SIGN, used in this manner, IS TRUE.

On the basis of the above example it is possible to provide a temporary proposal – the following definition of lying:

X IS LYING WHENEVER HE UTTERS A FALSE SENTENCE, KNOWING THAT IT IS FALSE, AND DOES SO TO HAVE THE RECIPIENT OF SUCH AN UTTERANCE MISLEAD, I.E. TO HAVE THE RECIPIENT CONSIDER IT TO BE TRUE.

Is the above definition correct? We will now attempt to analyse it.

2 What Kind of Beings are Lies and Lying

What kind of being is a lie? Is it a real or a fictional object, a feature, a phenomenon, a state of affairs, a situation, an event (occurrence) or a process?

The sentence from our example “I’ve been held up in the office by an important conference” may be treated either as an EXAMPLE OF A SENTENCE or a SENTENCE AS A TYPE. In the first instance this would be a concrete object, e.g. the speech apparatus of the speaker, vibrating by articulation of sounds, which comprise this example of a sentence, and the environment vibrating as a result thereof, i.e. the air and the objects in the vicinity of the speaker. On the other hand, a sentence as a type is not a physical object, but a set in a set theory sense, i.e. an abstract object. Therefore, the presented sentence may be considered either to be a PHYSICAL OBJECT or an ABSTRACT OBJECT. We are dealing with the former when we say that a lie was this utterance sent by Mr. X in a concrete situation, which is composed of the place, time, the person of the addressee, the circumstances preceding the sending of this utterance and many other things. The latter is the case when we say that this type of expression in a certain kind of situation is a lie.

The above observation entails another. The considered sentence is not a lie, if it has been isolated from THE CONTEXT OF ITS USE, i.e. the person of the sender, the place and time and generally, the situation of the sending

of the utterance, the person of the recipient and the situation of the receipt. For it to be a lie, the abovementioned factors need to be added thereto. It is only TOGETHER WITH THE ACCOMPANYING SITUATION THIS SENTENCE may be classified as a LIE.

What is therefore the ontological status of a SITUATION? Into which category of beings does it fall? The answer to this question depends on the philosophical views of the person answering. Some believe that a situation is no different from such and such things: inanimate and animate things, and among the latter non-psychological beings such as plants, and beings with psychological life, e.g. humans and animals, which exists in one way or the other in a given time and place. From this point of view, a situation is a COMPLEX PHYSICAL BEING, something concrete. Others perceive the situation as an ABSTRACT BEING: not such and such things but the fact that these things are such and such. These two standpoints are possible if one has in mind a particular unique situation. If however one thinks of a TYPE OF SITUATION, one must agree that a situation is an ABSTRACT BEING. Therefore it appears that each of the elements of a lie, both the sentence as well as the situation, may be interpreted in two ways: either as a concrete, physical thing, or as an abstract or ideal being.

The case is similar in the case of LYING. According to some it is no different from a person lying at time *t* AS SUCH, i.e. an animate concrete object with psychological life, acting in a certain manner. In the opinion of others lying is either an attribute of the lying person or a certain ACTION, OCCURRENCE or PROCESS – and by no means a concrete, physical object.

What kind of beings therefore are a lie and lying? These may be both CONCRETE THINGS, as well as BEINGS BELONGING TO OTHER ONTOLOGICAL CATEGORIES. The same is with signs – they may belong to each ontological category. And so each B1 – each thing, attribute, phenomenon or occurrence – may be used as a sign of any B2, different from B1, similarly, each thing, attribute, phenomenon, occurrence or situation may be used as a lie.

3 Semantic Features of a Lie

Let us stop for a while over the concepts of the verbal lie and of verbal lying. Are lying and a lie connected only with falsehood? Is it true that every time one is lying, either in writing or in speech, she/he formulates a false sentence; are only false sentences lies? Can a true sentence be a lie? Can a lie be a sentence deprived of logical value, i.e. a sentence which is neither

true nor false? Can a lie be a non-sentence expression, i.e. an expression which cannot be qualified on the basis of its logical value?

Let us imagine the following situation. Peter promised that today he would return his debt to a friend living in a neighbouring town. Since he does not have the money, he calls his friend and tells him that he is not able to come, because the trains are not running due to a malfunction. It turns out that at the same time due to technical reasons train traffic on this line was indeed suspended, which Peter does not know about. When he is calling his friend he thinks that he is uttering a false sentence and is doing so in order to mislead his friend, whereas in fact this sentence is true.

Is it therefore necessary for a sentence to be a lie it must also be false, or is it sufficient for the speaker to CONSIDER IT TO BE FALSE? I opt for the second solution. As a result thereof, the above definition of lying shall be modified in the following manner:

X IS LYING WHENEVER HE UTTERS A SENTENCE, WHICH HE CONSIDERS TO BE FALSE, AND DOES SO TO HAVE THE RECIPIENT OF SUCH UTTERANCE MISLEAD, I.E. TO HAVE THE RECIPIENT CONSIDER IT TO BE TRUE.

It is therefore visible that what counts is not the semantic feature of a lie, i.e. the falseness of the sentence qualified as a lie, but only its pragmatic features, namely: firstly – the attitude of the speaker towards the contents and the truth value of the uttered sentence – the speaker considers the sentence to be false – and secondly the intention of the speaker: he wants to mislead the recipient.

Can therefore a grammatical sentence which IS NEITHER TRUE NOR FALSE be a lie? Such sentences are analysed in the theory of truth value gaps, i.e. gaps in ascribing to a sentence its truth value. They are sometimes considered to be void sentences in literary works, i.e. sentences which refer to non-existent beings, such as sentences on Sherlock Holmes. If, according to the second version of our definition, we assume that no such or other truth value is co-decisive on whether a sentence is a lie, but the fact that the sender considered this sentence to be false, then we may also consider as lies so called void sentences which, according to the truth gap theory, are neither true nor false, such as *Sherlock Holmes played the flute*, if the speaker considers it to be false and wants to mislead the recipient.

We have reached the conclusion that BOTH FALSE as well as TRUE SENTENCES AND SENTENCES WHICH HAVE NO TRUTH VALUE may be used in the role of a LIE.

Nonetheless, in the light of the second of the abovementioned definitions

of a lie, it is connected with the truth and falseness to such an extent, to which the lying person considers the sentence he utters to be false and utters it in order for the recipient to consider it to be true. It may be therefore assumed that the views on problems of the truth do not affect the standpoint with respect to the notion of lie.

As it is known, there are several theories of truth, and therefore of falsehood; these have been presented in a clear and concise manner by Jacek Jadacki (1986), from which we have taken the following enumeration:

According to the classical definition of truth, i.e. the correspondence definition of truth, using the notion of consistency of the judgement with the state of the facts, *Veritas est adaequatio intellectus et rei, secundum quod intellectus dicit esse quod est, vel non esse quod non est* – the truth is the consistency between comprehension and a thing consisting therein that we believe that it is (so and so) about what is (exactly this way) or that it is not (so and so) about what is not (so).

The coherence theory of truth, connected with the name of Leibniz, as the universal criterion of truth of a given sentence indicates the fact that it is not inconsistent with respect to the remaining sentences within a given system or whether it is possible to infer such a sentence from the latter in a finite number of steps.

The so-called obviousness theory of truth sees the universal criterion of truth in the fact that we are ready to accept a given sentence without any hesitation, and this is due to its clarity and distinctiveness, i.e. the features emphasized by Descartes: *Verum est quod clare ac distincte percipio*, truth is what I see clearly and distinctively.

According to the pragmatic theory of truth the universal criterion of truth of a sentence, or more broadly – of an action – is the usefulness in some respect for the individual or for society of the state of affairs to which a given sentence pertains or the effectiveness for some respect of a given behaviour, be it linguistic behaviour or action; Peirce, James and Dewey are the propagators of this theory.

The so-called operationalist theory of truth sees the universal criterion of truthfulness of a sentence in its decidability, understood sometimes, e.g. by Bridgman, as existence of a method of deciding on a given question.

Finally, the theory of experiential verifiability of truth, propagated i.a. by Schlick, considers a sentence to be true when it either itself pertains to the observable state of affairs, or whose consequences pertain thereto. These theories are not universal: each of them is possible to apply only to certain categories of expressions or actions, however, these theories are not mutually

exclusive but rather supplementary with respect to one another. On their basis it is possible to construct relevant theories of falsehood and subsequently of a lie. And so: the semantic features of a lie are characterised by the classical, operationalist and truth verifiability theories; partially semantic and partially syntactic features of the properties of lies are explained by the coherence theory and the theory based on the notion of obviousness; the pragmatic theory, as the name itself indicates, focuses on the pragmatic features of a lie.

4 Pragmatic Features of a Lie

Does X, whenever he is lying by uttering or writing a certain sentence, need to consider the sentence to be false? This is what follows from the modified definition of lying. Maybe it was inapt and requires further modifications? Can X use for lying a sentence, which he considers to be true or with respect to the truth value of which he has no conviction whatsoever?

Before we try to answer this question, we need to draw our attention to the second pragmatic component of lying: the intention of the speaker to mislead the recipient. We omit here the disinterested autotelic, so called “children’s” lies, which are uttered as a kind of fantasizing, close to literary activity.

MISLEADING consists in the fact that recipient TAKES THE FALSEHOOD TO BE TRUE, and at another time in the fact that the recipient TAKES PARTIAL AND IMMATERIAL TRUTH TO BE THE WHOLE TRUTH or in the fact that the recipient TAKES THE TRUTH TO BE FALSE, and according thereto, the recipient acts or refrains from acting, and in other instances the misleading consists in the fact that something WHICH IS DEPRIVED OF TRUTH VALUE is treated by the recipient in certain cases as being TRUE and in other cases as being FALSE, and as a consequence thereof the recipient still acts inadequately.

A lie not only needs a lying person, but also a person who is or has been deceived. The former, the speaker, when lying, sometimes uses a sentence which he believes to be true or with respect to the truth value whereof he has no opinion whatsoever.

This category of lying may include instances, when the lying person is counting on the fact that the recipient will apply A DIFFERENT CRITERION OF TRUTH than the speaker. For example the speaker, who intends to lie, uses a sentence which he himself considers to be true under criterion C1, however, he is counting on the fact that the recipient will consider it to be false under criterion C2, which is different from C1. Let us imagine that

the speaker professes to some ideology and therefore considers under the coherence truth criterion some sentence taken out of that system to be true. Seeing, that this system is alien to the recipient and that the recipient will apply, for example, the obviousness criterion to this sentence, the speaker utters this sentence in order to deceive the recipient, i.e. to have him consider this sentence to be false and to undertake actions resulting from this opinion and to bear the consequences thereof. At another time, an author, writing or uttering a sentence, to which he ascribes no truth value, i.e. considers it neither to be true nor false, uses this statement of his, in order to have the reader or interlocutor, who applies a different criterion truth than the author, to consider the utterance to be true. These types of instances appear in texts of literary fiction, which are calculated to have the readers consider as true expressions contained therein, which are not judgments.

The above observations provoke us into introducing another definition of lying. It has the following form:

X IS LYING WHENEVER HE UTTERS A SENTENCE S, TO WHICH HE ASCRIBES TRUTH VALUE V1, AND DOES SO TO HAVE THE RECIPIENT OF SUCH UTTERANCE MISLEAD, I.E. TO HAVE THE RECIPIENT ASCRIBE TO THIS UTTERANCE TRUTH VALUE V2, WHICH IS DIFFERENT FROM V1.

Let V1 and V2 in the above formulation symbolize instances, when we ascribe no truth value to a given sentence.

The analysis of the notion of MISLEADING, appearing in all of the above versions of the definition of lying needs to be supplemented by a few remarks. The recipient in some sentences is deceived by the CONTENT of the statement of the speaker, such as it was the case with the sentence "I've been held up in the office by an important conference," uttered in a relevant situation. At another time the recipient may be misled by the fact that THE SPEAKER IS THE AUTHOR of the utterance or by the mere FACT THAT THE SPEAKER SAID SOMETHING. Then lying is successful not because of what has been said but because of WHO said it or THAT somebody said it. This is the manner in which a cynical politician could lie, who enjoys authority and is respected and trusted by credulous listeners. On the opposite pole we have a liar who constructs his lies on the fact that nobody believes him, which he himself is aware of. For this reason he utters the truth, which he wants either ignored or considered to be false. This way he MISINFORMS the recipients.

Such instance of a lie, which can be illustrated by the example of the sign "For adults only," put on a food item, for example chocolates containing liquor

or on a book not intended for children and young people, deserves a separate remark. The sender – the manufacturer or the publisher – CONSIDERS THIS ABBREVIATED SENTENCE TO BE TRUE and moreover IT IS TRUE. The sender also counts on the fact that minor recipients WILL BELIEVE IN THE TRUTH of this sentence and will be all the more eager to purchase the forbidden fruit. Lying here is not based on the difference between qualification of the logical value of the sign “For adults only” by the sender on one part and the recipient on the other. It consists therein that from the expression “For adults only” there follows an implicit prohibition addressed to the minors, issued by the sender in bad faith and for the purpose of it actually being broken.

5 The Axiological Aspect of a Lie

The formulation repeated in each of the above attempts at providing a definition of a lie, i.e. “in order to mislead the recipient” is PEJORATIVE. Therefore, this raises the question WHETHER A PERSON IS LYING if he intentionally says something which is not true, but does so in order to SPARE SOMEONE ELSE'S FEELINGS or CAUSE PLEASURE, e.g. a man who is asked by a woman “Do you love me?” replies that he does, despite the fact that the feeling is long gone, or the man when being asked “Do I look nice” answers “beautifully,” although something opposite has thrown at his head. Is a person lying, when she/he wishes to observe etiquette or does not want to bore the surroundings with her/his ailments and to the stereotypical “How are you?” she /he answers casually “Just fine,” although in fact she/he barely walks? Is a person lying when she/he HIDING THE TRUTH from a hopelessly ill person, or intentionally presents to this person her/his health condition falsely? Is a person lying when she/he provides a student with information diverging from the truth, although she/he knows it is not true, but does so in order to make it easier for the student to understand a problem, which is too complicated for the intellectual capabilities of the adept? Is a person lying when she/he presents to a child a consciously distorted, yet edifying, vision of reality in order to benevolently influence the child's moral development? In short, is a person also lying when she /he acts in accordance with the last provided definition of lying, but does so out of a noble intention, being driven by the welfare of the recipient or the social good, and moreover, achieves her/his purpose? Does the category of lies contain also noble lies, or are noble lies no lies at all, since only reproachful acts are stigmatized with the appellation “lie.”

These questions and doubts are on the borderland of ethics and semiotics,

in particular a section thereof called pragmatics. This is however not a place to dwell upon them; these remarks are limited to the field of semiotics, and out of necessity we leave these significant and interesting questions unanswered. Although solving them may be facilitated by a regulatory definition of lying and of lie, yet the choice of this or that definition will depend, among others, on the hierarchy of values we have adopted, and this already exceeds the limits of semiotics.

6 The Semantic Foundation of a Lie

In each and all of definitions of lying proposed herein, its core consists in the uttering of a certain sentence. Is it really necessary to verbalize a sentence in order to lie? More generally speaking, does lying need to be a verbal activity? No, it does not. Facial expressions, gestures, various actions, silence, refraining from doing something, presence or absence at a given time in a given place – all these can be lies in certain conditions.

Are humans the only ones to lie? I guess not: it is also the case with certain animals, e.g. a dog which rapidly demands to be taken out for a walk in the middle of the night pretending that it is *dura necessitate coactus*, forced by a hard necessity, when in fact all it wants to do is to take a run. Yet, in the animal world there is a fluent borderline between intentional pretending and spontaneous and inborn pretending, on one end whereof there is the natural mimetism or mimicry.

The borderline is also fluent in the human world between lying, pretending, hypocrisy, mystification, perfidy and deception. Yet, as one may think, the lie is the core of each of the above. A person who cheats when playing cards, pays with counterfeit money, trades in counterfeited products, presents false documents, forges someone else's signature, commits plagiarism, fails to keep his promise, breaks an agreement, manifests false kindness, sorrow or regret, is lying. And every person who is lying is always using a sign. THERE IS NO LIE WITHOUT THE USE OF A SIGN. LYING IS A SEMIOTIC ACTION, HAVING AT LEAST ITS SENDER AND ADDRESSEE, AND IN CASE OF AN ACCOMPLISHED LIE – ITS RECIPIENT. It is therefore also an action OCCURRING IN SOCIETY, and finally, it is a CULTURAL ACT.

I believe that deception may be reduced to a lie, and each LIE MAY BE REDUCED TO A CERTAIN LINGUISTIC BEHAVIOUR, CONSISTING IN THE SENDING OF A CERTAIN SENTENCE, TO WHICH THE SENDER ASCRIBES A DIFFERENT LOGICAL VALUE THAN, IN THE SENDER'S INTENTION, IS TO BE ASCRIBED TO THIS SENTENCE

BY THE RECIPIENT. For example, someone who adds glycol to wine, and then sells this mix as pure natural wine – is lying: in the sense that his non-verbal behaviour is tantamount to uttering the following false sentence “This is pure wine,” connected with the awareness that this is a false sentence, and with the intention to have the recipient convinced that this is a true sentence.

Here we have a typical example of a lie: a speaker utters a false sentence, knows that it is false, and is uttering it only to mislead the recipient into considering this sentence to be true. We are dealing here with a classical lie, we may say. Such a description does not usually raise any doubts or objections, in particular if one adds, that the sender was not acting with good intent.

But how should we qualify the remaining instances mentioned in the course of our deliberations, and namely those containing a sentence deprived of truth value, considered by the sender to be true or treated by the same as deprived of logical value; are these lies no more, or are these various concepts of lie, and therefore, in other words, various meanings of the word “lie,” or different intensities of lying, but in each case within the same sense of the word?

In order to answer this question one needs to be aware that both the fact that we proposed subsequent approximation to the definition of lie, as well as the contents of these definitions, it suggests that the concept of lie, and of lying, are typological and not classificational concepts. This results in the gradual nature of each of them: a greater lie – a smaller lie, he lies more – he lies less. This grade depends on whether one is lying in a more important or less important matter, whether one lies notoriously or exceptionally, whether the damage caused to the recipient is smaller or greater. But maybe it depends also on the semantic and pragmatic features of a lie, included in the subsequent above proposals of the definition of a lie, namely, whether one is lying with the use of a false sentence, or merely with the use of a sentence which the sender considers to be false, or finally with the use of a true sentence, which the sender considers to be true, but counts on the fact that the recipient will not acknowledge its truth or will take a partial truth to be the whole truth.

Bearing in mind the typological and so the gradual character of the concepts of lie and of lying, one may consider as less material the terminological issue, whether only the first of the discussed instances, “I’ve been held up in the office by an important conference,” should be called a lie, or maybe the remaining as well, and whether in all the remaining cases there is a different

concept of lie or merely there is a difference in its intensity.

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