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DEFINITENESS-INDEFINITENESS CATEGORY AND LOGICAL QUANTIFICATION

Abstract

This work has been written within the "Logic and Language" project, realized under a cooperation agreement between the Institute of Slavic Studies of the Polish Academy of Sciences and the Institute of Bulgarian Language of the Bulgarian Academy of Sciences. The publication of a many-volume Bulgarian Polish Grammar (12 monographs), and of a Polish-Bulgarian Contrastive Grammar, from now on: Synthesis, is completed. Theories of mathematical logic are satisfied in perfect way in a natural language, which is shown by our understanding of the semantic definiteness / indefiniteness category as a system of scope-based quantification notions. A natural language complements and modifies logical theories. For example, *understanding of the definiteness / indefiniteness category as a sentence category follows from the language material, especially in article languages.* In such languages, quantification of the predicate is a necessary prerequisite for interpretation. Also introduction of the notions of *strong and weak quantification meanings* is motivated, for example, by the need to distinguish between the meanings of expressions like Pol. *pewien x, jakiś x* / bułg. *njakoj x, njakakyv x* on the nominal phrase level, and by understanding of the ambiguity of quantification expressions like Bulg. *vinagi, ponjakoga* / Pol. *zawsze, czasami.* The fact of treating the definiteness / indefiniteness category as a sentence category *expands understanding of the incomplete quantification notion also with respect to the verbal phrase,* rather than, as in Ajdukiewicz's approach, with respect to the nominal phrase only. Similarly, a proper name in a natural language is not a unique name, like in mathematical logic, but requires additional unique quantification. A *network-based description of time* is the first attempt at this type of description in the subject literature. In the present article, I stress that fact that *quantification of states and events understood as in Petri net theory* reveals the dependence between the aspectual and temporal meanings of verb, and proves that the information on time and aspect need not be dealt with separately.
Keywords: scope-based quantification, definiteness/indefiniteness, strong and weak quantification meanings, incomplete quantification, state quantification and imperfect aspect, event quantification and perfect aspect, network-based description of time, Petri nets.

1. Logic and natural language

This work has been developed within the "Logic and Language" Project, implemented under a cooperation agreement between the Institute of Slavic Studies PAS, and the Institute of Bulgarian Language of the BAS. The publication of a many-volume the Bulgarian Polish Contrastive Grammar — 12 monographs, and a Polish-Bulgarian Contrastive Grammar, from now on: Synthesis (Koseska, Korytkowska, Roszko 2007) is completed. As the editor of the Grammar and a multiple co-author, more than once I was forced to accept scientific opinions of my co-authors that I could not fully agree with. Being a co-author is much more difficult than being a single author of a scientific monograph.

In the present work I want to dwell on my own position concerning the semantic definiteness-indefiniteness category and its connection with logical quantification, and on the description of temporal and aspectual issues with help of a mathematical theory known as Petri nets. Many linguists are of the opinion that mathematical logic and its theories have little in common with a natural language. However, there are also linguists who think that one cannot deal with contemporary semantics and a natural language without the apparatus and theories of mathematical logic. The relation between logic and language is interesting, also because it is not only logical theories that are useful for describing the semantics of a natural language, but also the material from the natural language complements and modifies some of the logical theories. I will try to show this here. When Volume 2 of the Bulgarian Polish Contrastive Grammar (Koseska, Gargov 1990) was submitted for printing, a fierce discussion was going on whether logical quantification can explain the use of the definite article, or rather its absence, see (Koseska, Gargov 1990). The main subject of the dispute was whether one can talk about the phenomenon of quantification in a natural language at all. Today, the theoretical stream of research on quantification in a natural language is to resolve which of the logical quantification theories is more useful for describing the natural language phenomena: the traditional Frege theory, or a non-Frege one. See: (Desclés 1999).

It is worth reminding here that the foundation of the Bulgarian Polish Contrastive Grammar are semantic theories concerning external capabilities of a natural language to denote the real world. Language forms group themselves around the way in which thy describe the real world rather than around the ideas that they express. Those semantic theories are known as *theories of direct relationship to the semantics.*

2. Basic notions connected with logical quantification

Using the generally adopted definitions of logical quantifiers and the iota-operator, I employ here three basic notions whose meanings are determined by language exponents of logical quantification (Rasiowa 1975: 211–255) and definite description (Russell 1967: 253–293), see (Koseska 1982). Quantification of natural language expressions can concern names (first-order logic), but also predicates (second-order logic). As a quantifier transforms a logical predicate

into a logical sentence, by no means can predication be identified with quantification, which is the case in some linguistic works. By *existentiality* I mean here expressions of the form

$(\exists\ x)\ P(x)$

preceding a predicate, i.e., a sentential function P (from now on, P), in the semantically-logical structure of a sentence which is read using the phrases, "there is an x such that", "for some x". By *universality* I mean expressions of the form

$(\forall\ x)\ P(x)$

preceding a predicate P in the semantically-logical structure of a sentence. In turn, by *uniqueness* I mean an expression of the form

$(\iota\ \mathrm{x})\ P(x)$

assuming that a given sentential function P is satisfied either by exactly one element of the considered universe, or by one and only set of elements. As already accepted in logical literature, I treat the iota-operator as a unique quantifier. The "quantification method" understood as above is not a "syntactical operation" transforming a sentential function into a sentence. It is a mechanism revealing the semantic relationship between the quantified object or set and a truth-based method of forming sentences, e.g. the set '$(\iota\ X)$ is a featherless biped' is the *unique* set that satisfies the predicate $P(X)$, where $P(X)$ means 'X is the set of all people'. Each quantification reduces the number of (free) variables of the quantified predicate. It seems natural to classify as quantification substitution of a unique object for a certain variable of a predicate, since such an operation also reduces the number of free variables. This is how the iota-operator was treated in works of Barwise and Cooper (Barwise, Cooper 1981: 159–219), whose quantification model concerned the nominal phrase only, and in the Bulgarian – Polish Contrastive Grammar, Vol. 2 (Koseska, Gargov 1990), where that model concerned *also the verbal phrase and the whole sentence. The thesis that the definiteness / indefiniteness category is not a category of the nominal phrase, as authors of the subject literature used to think, but a category of the sentence, was first proved in:* (Koseska 1982).

In each of the languages I know, understanding quantification expressions poses a serious difficulty. Some of those expressions can even appear in homonymous meanings, i.e. meanings in which the quantification changes in an essential way depending on the language context in which they occur. For example, the expression "one such that P" is a unique expression in a context which implies that the predicate P is satisfied for one and only one object only. Then the above expression can be written down as an expression with the iota-operator, i.e. as $(\iota\ \mathrm{x})\ P(x)$. See:

V negovija klas samo edin (edin) uchenik ne izdyrzha izpita.

W jego klasie tylko jeden (jeden) uczeń nie zdał matury.

The expression "one such that P" can be understood in a context different from the above one also as an existential expression, i.e. as "there exists a certain object such that P", or as "some object satisfying P", or as "there is at least

one object such that *P"*. Then the above expression can be formalized as ($\exists$ x) P(x). See:

Edna devojka te tyrs`i po telefona.

Pewna dziewczyna telefonowała do ciebie.

It should be stressed that Bulgarian *edin* can also express universal quantification: *Edin myzh i na 80 godini mozhe da se ozheni.*

In Bulgarian the most typical morphological mechanism expressing universality or existentiality in the nomen group is deemed to be the *article*. Its absence, i.e., morphological 0, is meaningful, since it is an exponent of existentiality, or pure predication. The ambiguity of the Bulgarian article, as well as the expressions *każdy* and *jeden* discussed above, are a good illustration of the difficulties encountered by a researcher studying this category when carrying out quantificational classification of natural language expression. A topic deserving separate, detailed studies are also the differences in distribution of quantificational expressions of universality, existentiality and uniqueness in Bulgarian and Polish, such as distinguishing the contexts for Polish *pewien* compared to those for *jakiś, jeden,* and their comparison with Bulgarian *njakakyv, njakoj, edin* and with absence of the article. A review of the contexts of occurrence of Polish *ktoś, ktokolwiek* and Bulgarian *njakoj, vse njakoi, koj i da e;* Polish *od czasu do czasu, czasami, czasem, chwilami* and Bulgarian *ponjakoga, ot vreme na vreme* is also very interesting. Even a very superficial comparison of Polish and Bulgarian lexical exponents for existentiality of time indicates an interesting fact, which is, e.g., the large number of those exponents in Polish compared to their analogues in Bulgarian (Koseska, Gargov 1990), (Koseska 2006).

3. The definiteness/indefiniteness category — a sentence category

Treating the definiteness category as a sentence category and the attempt to take into consideration also quantification on the verbal phrase level help track the development of the Bulgarian article meaning. As I have already mentioned, in Bulgarian the same article form can express both uniqueness and universality (and hence, respectively, definiteness and indefiniteness). In the already cited book (Koseska, 1982), I posed a hypothesis regarding the semantic development of the Bulgarian article. In my opinion, the article initially expressed *uniqueness of an element (object)*, and then started to express also uniqueness of a set. Due to equalization of two completely different semantically-logical structures, i.e. ($\forall$ x) $P(x)$ and (ι x) $P(x)$, this lead to a homonymy, and to the article expressing also universality. See:

(1) *Deteto e ot klasa na Marija. 'This child is from Maria's clas''.,* where the article *-to* expresses uniqueness of the set of children, and

(2) *Chovek-yt e misleshto i razumno syshtestvo 'Each man (and only they) is a thinking and reasonable being.',* where the article *-yt* expresses uniqueness of the set. (Only the set of people satisfies the predicate: *x is a thinking and reasonable being).*

On the other hand, in

(3) *Chovek-yt e smyrten. 'Man is mortal/ Each man is mortal.',*

the article *-yt* expresses universality. Not only this form of the Bulgarian article, but also its other forms can express both uniqueness and universality. Similarly, in English, French, Rumanian and Albanian an article form can express both uniqueness and universality. This shows that the above homonymy is of a universal rather than typological (e.g., Balcan) character. For a detailed discussion, see (Koseska-Toszewa 1986).

The above observations, based first of all on the semantically-logical aspects of the definiteness category, were confirmed by me in language materials from the Supraśl Code (Zaimov 1982: 5–9), in which the Bulgarian article does not occur in universally quantified nominal structures, but in uniquely quantified nominal expressions, and denotes satisfaction of a predicate by either a single element of a set or by the whole set, treated as the only one.).

4. Weak and strong quantification meanings

In the second, volume of the Bulgarian-Polish Contrastive Grammar, together with Georgi Gargov, we proposed distinguishing the above meaning differences within the same quantification using the labels of strong and weak quantification meanings, determined based on secondary semantic properties of the expressions.

The strength of a quantification meaning is determined by the quantifier's position in the semantic structure of the sentence (This should not be confused with the formal structure of the sentence!). If the quantifier has the broadest scope in the semantic structure of the sentence, i.e. if its scope covers all other quantifiers occurring in the semantic structure of the sentence, then we speak of a strong quantification meaning. If the quantifier's position is contained within the scope of other quantifiers present in the semantic structure of the sentence, then the quantification meaning is strong. Hence in case of the sentence:

> *Vsichki bjahme angazhirani v edna (njakakva) rabota, kojato ni otnemashe cjaloto vreme. / Wszyscy byliśmy zaangażowani w pewną pracę, która nam zabierała bardzo dużo czasu.*

[We were all involved in a certain work which took us lots of time.] we have the following interpretation: 'There is an object (*pewna praca*! – certain work) for which it is true that for a unique set (we – us) there was a state in the past (byliśmy zaangażowani — we were involved) such that for each of us it was true that we were involved in the same object, i.e., the work was the same!' The existential expression *pewna praca / edna rabota* has the broadest scope of quantification in the semantic structure of the sentence and covers other quantifiers, i.e. the unique quantifier (we all) and the existential quantifier (there was a state of <<being involved>>.) The expression pewna praca / edna rabota has a strong quantification meaning.

On the other hand, in case of the sentence:

Vsichki bjahme angazhirani v edna (njakoja) rabota, kojato ni otnemashe cjaloto vreme. / Wszyscy byliśmy zaangażowani w (jakąś) pracę, zabierającą nam bardzo dużo czasu.

'We were all involved in a work taking us lots of time.' we have the following interpretation: `For a unique set (we – us), it is true that there was a state in the past (we were involved) and that for each of us it is true that there existed an object (here work!) that involved us. However, such an object (work) could have been different for each of us.' In this case, the expression: *edna rabota – njakoja rabota. / praca – jakaś praca* has a weak existential meaning, since it is located within the scope of two quantifiers: the unique quantifier (we all) and the existential quantifier (there was a state of <<being involved >>.) In the first case, the factor of the greatest importance for the semantic structure of the sentence is the information about the unique work that all performed, and in the second — the information on that unique set (we all) performing some work. There is no doubt that distinguishing between strong and weak quantification meanings also for quantification of time introduces a lot of new ideas into the interpretation of temporal meanings both in Bulgarian and in Polish.

The expressions *ponjakoga / czasem, czasami* chosen here by way of example are ambiguous, and can have, depending on the context, either strong and weak quantification meanings, see (Koseska, Gargov, 1990).

5. Quantification of time, aspect, or of time and aspect?

My motivation for asking this question were many years of discussions carried out at the meetings of a Polish-French team dealing with cognitive grammar problems. In Vol. 2. of the Bulgarian Polish Contrastive Grammar (Koseska, Gargov 1990), we examined quantification of semantic categories of time and aspect without separating both these categories. The question: "Can we speak about time without speaking about the aspect as well?" is still relevant for many authors. The discussion shows that separation of those two semantic categories is a problematic operation. The information about the so-called imperfect aspect is connected not only with the "spread", but also with , "breakability" or "repeatability" *of states and events understood in the same way as in Petri nets,* see. (Petri 1962), (Mazurkiewicz 1986), (Koseska, Gargov 1990). In Slavic languages, singularity as well as uniqueness are usually expressed through the *perfect aspect*, and in Bulgarian also through the aorist form of perfect verbs, and sporadically through the imperfectum form of perfect verbs. On the other hand, universality and existentiality are expressed through the *imperfect aspect* of verb, and in Bulgarian also through the imperfectum form of imperfect verbs, and even through the aorist form of imperfect verbs. "Repeatability" characterizes not only information about time, but also information about aspect, and in this case separation of the two categories, were it possible, would be very artificial.

In the linguistic literature, morphological means for expressing the definiteness category in the verbal group in both languages have been noted rarely, see only (Grzegorczykowa 1976, Koseska 1982). The elements quantified on the

verbal phrase level are first of all time and aspect as well as the location of a continuing state, or occurrence of an event. A special case of quantification is *quantification of the multiplicity of a state or an event, or of their* combination, revealed on the morphological level in both languages only through information about the *aspect of perfect and imperfect verbs,* and on the lexical level through expressions of the type: Polish *jeden (jedyny) raz / wielokrotnie, nieraz* and Bulgarian *samo edin pyt / mnogo pyti, ne edin pyt.*

While time and place quantification can be easily presented using the notions of existentiality and universality as opposed to uniqueness, the *multiplicity quantification* is limited first of all to the opposition between singularity and multiplicity (not to be confused with repeatability), without any special distinction between existentiality and universality, see (Koseska 1982). A lot of authors would associate *scope-based quantification* – in my opinion, erroneously – with aspect only. Interestingly, the Bulgarian aorist form, *independently of the information about the aspect, always* reserves place for a uniqueness quantifier only. Quantificational uniqueness is expressed with the aorist forms of both perfect and imperfect verbs. In Bulgarian, none of the aorist forms appears next to an existential or universal quantifier, see the impossibility of constructing the sentences: ** Toj hod'i tam ponjakoga (vinagi)., * Toj vinagi (ponjakoga) zamina za Sofija., * Toj vinagi (ponjakoga) se lekuvá.* This is a language fact deserving special notice! The distribution of the aorist forms is limited to language situations involving a uniqueness quantifier, while the imperfectum form of imperfect verbs, as well as praesens, have no limitations of this type, and are encountered in contexts with universal, existential as well as unique quantifiers. See *Toj* ***vinagi (ponjakoga, tazi godina)*** *chodeshe do majka si v nedelja.*

6. Petri nets, quantification of states and events

The basic semantic elements of both aspect and time are a *state* and an *event,* understood as in Petri nets. (Petri 1962) The fundamental feature distinguishing those notions is the *temporal spread of states* and the *momentary character of events*. Hence in case of *states* we have to do with information about the *imperfect aspect* of verb, while in case of *events* – about the *perfect aspect* of verb*!* States "last", while events can only , "happen". An abstract analogue of this distinction is the difference between a section of a straight line (state) and a point lying on it (event).

In view of the adopted postulate that the Petri net model is finite, we cannot limit our description to events only, and in consequence treat states as sets of events, as e.g. Reichenbach (1967) did. An attempt to describe a state as a set of events leads to the questions: "A set of what states? All, or only some of them? And if some, than how should they be chosen?" Similarly, when we are talking about a section of a straight line, we cannot give all points that belong to it; however, we can specify that section in a finite way by giving its start and end points. In turn, skipping events in the model and limiting the latter to states only deprives us of the possibility to consider such phenomena, as "collision", "opening", "unveiling", "awakening", and the like. An event may

not be the beginning or the end of a single state only, and hence it cannot be treated solely as an ordinary transition – "transition from one state into another". Consider, for example, a very simple sentence: *I have started slimming down.* We have here an event which gives the beginning of the state "slimming down", which has lasted before the speech state. We do not know what event will break the state of slimming down, but we know that there is yet another event which has occurred before the speech state and has joined the state of slimming down with the speech state. The temporal situation in the Polish compound sentence: *Zaczęłam się odchudzać i jeszcze jestem na diecie* can be presented in English with help of a single predicate sentence, since English distinguishes between the contents of present perfect and past simple forms. In the sentence: *I have been slimming down*, the event has started the state of dieting which lasts during the speech state, like in the Polish compound sentence: *Zaczęłam się odchudzać i jeszcze jestem na diecie.* In Bulgarian, in a similar case we encounter the perfectum form with a resultant meaning, see *Otslabnala sym (tova se vizhda).* As we can see from these examples, an event can start a state lasting before, during and after the speech state.

We should stress here that using Petri net theory we can interpret states not only statically, but also dynamically, and hence broader than traditionally, since we take into consideration their relationships with events. As emphasised in previous works (Mazurkiewicz 1986, Koseska, Mazurkiewicz 1988, Koseska, Gargov 1990), the network-based description of time in sentences selected from a natural language provides us with better possibilities of describing this semantic category of the language compared to, e.g., the linear description of time used by Reichenbach. In Bulgarian and Polish, states and events are distinguished first of all using perfect and imperfect verbs. It seems interesting that *imperfect verbs denote states, and perfect verbs. — events,* e.g., verbs of the type: *rozpocząć, skończyć / (da) zapochna, (da) zavyrsha,* denote events, while verbs: *pracować, żyć / rabotja, zhiveja* denote states. In the sentence:

Ja właśnie kończę pracę / Az tochno zavyrshvam rabotata si.,

the verb *kończę / zavyrshvam* denotes the state of nearing the end of some type of activity, while in the sentence:

Ja skończyłem pracę. / Az zavyrshih rabotata si.

the verb with perfect aspect denotes an event braking some type of activity.

7. Linear and network-based descriptions of time

In the description based on a linear time scale, each two considered events (or states) must be placed at some specific points of the time axis, and hence must have a fixed order on that axis. In turn, a network-based description allows us to show absence of order between events (states), as well as the fact that an analysed utterance does not refer to such an order. The proponents of the continuous (= linear) position give as the basic argument supporting it the necessity to introduce the notion of a process in which a certain quantity (or quantities) vary in a continuous way, see (Koseska 2006). However, no additional notion is needed, since in networks a „process" is represented by a *configuration of states and events.*

A novelty to which we should pay particular attention in our works is *quantification* of *events and states* understood as in Petri nets. It is just thanks to the networks that temporal situations in a natural language can be described otherwise than linearly, as has been the case up to now in the subject literature, and the temporally – aspectual meanings can be interpreted jointly.

Examples with quantification of states:

> ***Vinagi, kogato misli za neshto vazhno****, zhena mu go moli da j pomaga.*
>
> ***Zawsze, kiedy myśli o czymś ważnym,*** *żona prosi go o pomoc.*
>
> ***Vinagi, kogato misleshe za neshto vazhno****, zhena mu moleshe da j pomaga.*
>
> ***Zawsze, kiedy myslał o czym ważnym,*** *jego żona prosiła go o pomoc.*

Universal quantification of states is expressed in Bulgarian with lexical means of the type: *vinagi ,* the praesens i imperfectum forms, and the imperfect aspect of verb. In Polish, general quantification of states is expressed with lexical means of the *zawsze* type*,* the praesens and praeteritum forms, and the imperfect aspect of verb.

> ***Ponjakoga, kogato misli za neshto vazhno****, zhena mu go moli da j pomaga.*
>
> ***Czasem, kiedy myśli o czymś ważnym,*** *żona prosi go o pomoc.*
>
> ***Ponjakoga, kogato misleshe za neshto vazhno****, zhena mu go moleshe da j pomaga.*
>
> ***Czasami, kiedy myślał o czymś ważnym,*** *jego żona prosiła go o pomoc.*

Existential quantification of states is expressed with lexical means of the *ponjakoga / czasami* type and the praesens and imperfectum forms in Bulgarian, with the praesens and praeteritum forms in Polish, and with the imperfect aspect of verb in both languages.

Ivan ***sega*** *pishe pismo.*

Jan ***teraz*** *pisze list.*

V tozi moment tochno *toj oshte ja obichashe*

W tym momencie właśnie *on jeszcze ją kochał.*

Unique quantification of states is expressed in both languages lexically with help of expressions of the *sega / teraz* types, as well as the praesens and imperfectum forms in Bulgarian, the praesens and praeteritum forms in Polish, and with the imperfect aspect of verb in both languages.

An interesting fact is in that in Bulgarian a unique quantification of states is expressed also with the aorist form of imperfect verbs, see Koseska 2006.

Examples with quantification of events:

Universal quantification of events.

Vinagi, napisheshe li *pismo, go izprashtashe po poshtata.*

Zawsze, kiedy kończył pisać list*, wysyłal go pocztą.*

In the above examples, universal quantification of past events has the following explication: 'Each time when Jan *finished* writing a letter, he sent it by mail'.

Existential quantification of events.

Ot vreme na vreme toj napisheshe *pismo i posle zabravjashe za nego.*

Od czasu do czasu on kończył pisać *list i potem zapominał o nim.*

In this case, in Polish quantification has been expressed lexically (*kończył*) rather than, like in Bulgarian, with help of the prefect aspect of the imperfectum form, see the explication: `There was an event in the past <<finishing of letter writing >>, which was followed by sending of the letter and forgetting about it.'

Unique quantification of events.

Ivan ***napisa*** *pismoto, sled kato Marija mu napomni za tova vtori pyt.*

Jan ***napisał*** *list, kiedy drugim razem przypomniała mu o tym Maria.*

In both languages, we have the following explication: 'In just this single case in the past, the event: <<finishing of letter writing by Jan>> occurred'.

Unique quantification (uniqueness) of events in Polish is expressed with help of verbal forms:

— *the praeteritum form of perfect verbs*, e.g. *Maria ukończyła studia.*

— *the ma plus participium construction applied to perfect verbs: Maria ma ukończone studia.*

— *the praeteritum form together with lexemes of the przedtem, wcześniej type.*

Maria wcześniej, niż Marcin ukończyła studia.

In turm in Bulgarian it is expressed with:

— *the aorist form of perfect verbs*: *Marija zavyrshi obrazovanieto si.*

— *the perfectum form of perfect verbs*: *Marija e zavpshila visshe obrazovanie.*

— *the plusquamperfectum form of perfect verbs*: *Marija beshe zavyrshila vissheto si obrazovanie predi Martin.*

In cases (1)–(4), despite identical quantification of events, we have noteworthy differences in meanings. Both Polish and Bulgarian sentences (1) and (3) differ in this respect from sentences (2) and (4). In the first case, we have the following paraphrase: 'Exactly one event in the past meets the conditions of finishing studies', while the paraphrase of sentences (2) and (4) reads as follows: 'For one and only one event in the past, it was true that it was the beginning of the state: she/he has university education, and that this state is coordinated with the speech state.'

8. Dictionaries and quantifying expressions

It should be stressed that quantifying expressions in Bulgarian and Polish are not unequivocal. This fact is interesting, especially in the light of lexicographic practice. Indeed, both Bulgarian and Polish dictionaries *disregard completely quantificational meanings of this type of expressions in both languages.* In both languages, quantifying expressions can have different meanings within the same quantification: universal, existential or unique one. For example, the universality expressions *vinagi / zawsze* have at least two meanings. Also the first meaning of *ponjakoga / czasem (niekiedy)* is analogous to the meaning of *zawsze / vinagi* when *zawsze / vinagi* are quantifiers running over a set of relevant cases (conditions). In this sense, the expressions *ponjakoga / czasem, czasami* are quantifiers running over the set of conditions (states) that are referred to in the sentence, e.g. *Toj ponjakoga ja synuva. On śni czasem (czasami) o niej*, i.e.: 'Sometimes when he is asleep he sees her in his dream.' In this sense, *ponjakoga / czasem, czasami* have a meaning close to that of Bulgarian *pone edin pyt, po njakoe vreme, v njakoi sluchai,* and, similarly as the Bulgarian exponent of universality *vinagi*, never appear with aorist of perfect verbs. However, we encounter it next to the imperfectum and the praesens of imperfect verbs. I would like to remind here of the impossibility to construct a Bulgarian sentence with *vinagi* or *ponjakoga* appearing together with the aorist of perfect verbs, i.e. * Toj ponjakoga otid`e na rabota.

9. Incomplete quantification

Polish and Bulgarian differ fundamentally with regard to incomplete quantification. As Ajdukiewicz wrote in his Pragmatic Logic "...we will call an expression, in the context of its certain meaning, a statement (or a sentence in the logical sense) if the expression expresses, given just this meaning, some judgment, i.e, some thought that refers in a reporting way to some state of things." Ajdukiewicz calls statements sentences in the logical sense. In his opinion, they

have a certain common property that distinguishes them from all other kinds of sentences. "Namely, all statements (and only them!) are either true or false."

In a natural language, we often encounter statements without either true or false value, such as the sentence *Englishmen are phlegmatic* from Pragmatic Logic. Ajdukiewicz draws attention to the fact that this sentence is an example of incomplete quantification, and hence it has neither the false nor the true value. This is because we do not know whether it refers to *all Englishmen, their majority, or only some Englishmen.* Roughly speaking, the sender of this information does not know whether the predicate *X are phlegmatic is satisfied for the name Englishmen.* In this case, additional information is needed that could give a truth value to that predicate. The sentence lacks information about scope-based quantification of the name *Englishmen.* This phenomenon was noticed by Ajdukiewicz, and named *incomplete quantification.* Ajdukiewicz assessed the above phenomenon as an error in wording. Omitting of a certain component in a sentence prevents determination of its truth, and leads to misunderstandings. The scholars deemed that incomplete quantification or relativization leads to a failure to understand the speaker's intention, or to its corruption.

Observations of the semantic definiteness/indefiniteness category in Bulgarian and Polish show that incomplete quantification cannot be a simple linguistic mistake, since the languages differ from each other in that respect. We encounter this phenomenon in Polish more often than in Bulgarian. Ajdukiewicz speaks of incomplete quantification having in mind the nominal phrase only, while we will speak here of incomplete logical scope-based quantification having also the verbal phrase in mind.

Examples: Incomplete quantification "on the nominal phrase level" (like in Ajdukiewicz's approach):

Na dworze płacze dziecko. (existentiality) – (some child)

Na dvora plache dete. (existentiality) – (edno, njakakvo).

Praca ma największą wartość. (universality) – (each work).

Attention! *Rabotata e s naj – visoka stojnost* – Rabotata (work) is quantified universally here.

Incomplete quantification on the verbal phrase level is a novelty. On the verbal phrase level, incompleteness can concern existential, universal and unique quantification. In both languages, this applies to sentences without quantifying expressions of the type: *vinagi, ot vreme na vreme, ponjakoga / zawsze, niekiedy, czasami*, see: *Marija zakysnjavashe. Maria spóźniała się.* In both cases, we do not know whether *Maria spóźniała się zawsze, czy czasami, czy w tej chwili* (whether Mary has been always or sometimes late, or whether she is late just now).

Both languages differ form each other with respect to incomplete quantification. This fact can be explained by the differences in morphological systems of both languages. In Polish, incomplete quantification is an ubiquitous phenomenon. Incomplete unique quantification is limited in both languages, but in

Bulgarian it is not encountered on the nominal phrase level first of all because Bulgarian is an article language, see (Koseska, Gargov 1990: 138–139).

10. Summary

Theories of mathematical logic are perfectly satisfied in a natural language, as shown by the understanding of the semantic definiteness / indefiniteness category as a system of scope-based quantification notions. It should be noted that a natural language complements and modifies logical theories.

1. Understanding of the definiteness/indefiniteness category *as a sentence category follows from the language material*, especially in article languages. In such languages, quantification of the predicate is necessary for interpretation purposes.

2. Also introduction of the notions of strong and weak quantification meanings is motivated, e.g., by distinguishing such expressions, as *Pewien x, jakiś x / njakoj x, njakakyv x* on the nominal phrase level, and by understanding the ambiguity of quantification expressions of the type: *vinagi, ponjakoga / zawsze, czasami.*

3. Treating the definiteness/indefiniteness category as a sentence category broadens understanding of incomplete quantification also with respect to the verbal phrase. Similarly, in a natural language a proper name is not a unique name, as in mathematical logic, and requires "additional" unique quantification. This explains, among others, occurrence of the article with proper names, e.g. in Rodopite, see Rodopi – mountains in south Bulgaria. However, this is a subject for next works.

The network-based description of time is the first such attempt at describing time in the subject literature.

In the present work I stress the fact that quantification of states and events understood as in Petri net theory reveals the dependence between the aspectual and temporal meanings of verb, and proves that information on time and aspect need not be treated separately.

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