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BOŻENA CZERNECKA-REJ

ON FOUR TYPES OF ARGUMENTATION FOR CLASSICAL LOGIC

Classical logic[1] has been many times submitted to varied criticism and at the beginning of the second half of the 20th century—together with the progressing multiplication of non-classical logical calculi – its imminent death was even prophesied. Nevertheless, it still remains the most permanent paradigm of logic as a scientific discipline. It seems that the time has gone irrevocably when it was believed that two-valued logic did not only stand in conflict with our intuitions but using it might lead to contradictions. After numerous fruitless searches, the scientists even lost hope to create a better logic than two-valued logic[2]. Naturally, different types of non-classical logic function which solve certain local problems and which standard logic cannot cope with.

Leslie H. Tharp in his article *Which Logic Is the Right Logic?* puts the question about the properties that the correct system of logic should possess. He states that standard first-order logic is commonly considered to be the basic logical tool – "it appears not to go beyond what one would call logic, the problem evidently is whether it can be extended" (THARP 1975, 4). He

BOŻENA CZERNECKA-REJ, PhD Habil., Associate Professor at the John Paul II Catholic University of Lublin, Faculty of Philosophy, Institute of Philosophy, Department of Logic; address for correspondence: Al. Racławickie 14, 20-950 Lublin; e-mail: bozena.czernecka-rej@kul.pl; ORCID: https://orcid.org/0000-0002-2992-4560.

[1] "Classical logic" is understood here as the whole of first-order logic with identity. Leśniewski's ontology and higher-order predicate calculi, for example, may be described as classical in a broader sense (KWIATKOWSKI 2006, 117).

[2] „Not only the hope to show contradictions of classical logic […] but also the hope to create logic which will prove to be better from the former have been dispelled. Although the non-classical systems of logic have been studied and developed till today but the creation of numerous other systems of logic besides classical logic more and more rarely follows from the conviction that the latter has failed. It is rather believed that the created system of logic can prove to be a more useful completion of classical logic." (WÓJCIKI 2003, 176).

adds that the “The reasons for taking elementary logic as standard evidently have to do also with certain imprecise—but I think vital—criteria, such as the fact that it easily codifies many inferences of ordinary language and of informal mathematics” (THARP 1975, 17). There is no doubt that in research practice it is almost common and automatic that the choice of classical logic is made—it constitutes a sort of point of reference for further research.

It can be asked what reasons for the domination of first-order logic are and what desirable features it possesses. What paradigm of “logicalness” of logic does it designate? What is unchangeable to make logic remain itself and not lose its important task it owes to science?

The most coherent and complete argumentations aimed to justify the unquestionable position of classical logic include the following:

[1] Willard van O. Quine’s pragmatic-methodological argumentation;

[2] Jan Woleński’s philosophical-metalogical argumentation;

[3] Stanisław Kiczuk’s ontological-semantic argumentation;

[4] „argumentation from metalogic”.

The aim of the present article is to analyze the aforementioned argumentation lines for standard logic and to formulate a few critical and comparative remarks.

1. WILLARD VAN O. QUINE’S FIRST-ORDER THESIS

Quine’s classic view is known as “first-order thesis”. It says that the only ‘true logic’ is extensional first-order logic. Argumentation for this thesis is based on two assumptions, namely:

a) the holistic theory on the meanings of logical constants;

b) the maxim of minimum mutilation of science.

According to the first assumption, the meaning of each logical constant is determined by the principles defining all logical theses where this conjunction occurs. Each system of logic can then be treated as a system of postulates defining the meaning of logical constants. Violation of some element, e.g. rejecting any of the axioms, causes violation of the whole system of the meaning of conjunctions.

According to Quine, logic is a type of language constructed in a conventional way and that is why changing logic is changing the language, and thus changing the subject (QUINE 1986, 80). Because theorems are the consequences of the adopted meaning postulates, it is not possible to refute the theses of logic. Rejecting a given thesis from the system changes the meaning of logical constants in it and, therefore, it also changes the meaning of this thesis. The holistic concept of the meaning of logical constants goes together with the *thesis on difference of meanings.* The consequence of this theory developed by Quine is a specific logical fundamentalism: all theses of the logical system in the language of a given field of knowledge is a certain kind of indisputable foundation of this knowledge (BIŁAT 2004, 59).[3]

The maxim of minimum mutilation is connected with the defense of the privileged role that Quine attributes to the classical logic. Quine does not attribute such importance to the argument based on the obviousness of this calculus as he does to the reasoning referring to the *maxim of minimum mutilation.* He is aware of the fact that a representative of deviant logic[4] might treat *their* logic as obvious. The pragmatic principle of *minimum mutilation* provides the foundations to decide which system of logic is correct and constitutes the ultimate reasons after logical monism. The point is that all sciences, mathematics including, are based on classical logic and hence all attempts to introduce some other logic oppose this rule (QUINE 1986, 85).[5] *The maxim of minimum mutilation* appears as Quine's methodological postulate (speaking his language: "reasonable strategy") aimed to preserve the achievements of science basing on standard logic. In accordance with this maxim, theoretical difficulties that occur in a given field of science should be removed with the possibly minimal cognitive costs through a modification of theories that are at the farthest (considering generality) distance from logic.

Quine is the author and defender of the thesis on canonical logic, which — linked with his monism—can be understood in the following way: there is exactly one system of the richest (as for the power of expression) and universal (considering the scope of applications) logic—this is the first-order logic (SAGÜILLO, 150–51). Quine explains universality by pointing to invariance of logical truths under lexical substitutions. His words are characteristic: "The lexicon is what caters distinctively to special tastes and

[3] According to Andrzej Biłat, the combination of holism with the philosophical version of monism gives a fairly strong monistic version of logical fundamentalism: there is exactly one, undermineable system of canonical logic.

[4] Deviation calculi are those which – while being formulated in the language of the classic sentential calculi – have a different set of laws or correct inferences.

[5] It seems that Bolesław Sobociński had similar intuitions when he wrote that "adopting some system of many-valued logic as the basis of our reasonings […] would put science in a complete chaos." (SOBOCIŃSKI 1956, 31).

interests. Grammar and logic are the central facility, serving all comers." (QUINE 1986, 102).

What the American logician emphasizes apart from universality are the pragmatic advantages of this logic: it can be a model of clarity, elegance and efficiency (QUINE 1992, 142–45); moreover, it is free from paradoxes in addition to being "familiar, comfortable, simple and beautiful" (QUINE 1986, 87).[6] Due to its naturalness, classic logic seems neutral[7]. With the holistic concept of the meaning of logical constants, this pragmatic aspect is also of big importance. If the whole system of logic defines the sense of these constants, then to explicate them it would be irrational to choose a system that would be more complicated or less efficient in use. In this sense the very thought about deviation from standard logic, which has always been considered the most permanent element of our beliefs, seems to Quine irrational, if not absurd. He believes that for scientific purposes, classical first-order logic in fully sufficient—its extensional[8] language provides a canonical notation for all knowledge.

It deserves to be mentioned that Józef M. Bocheński, in the famous formula "beyond logic there is only nonsense", meant classical first-order logic enriched with the predicate of identity. He claimed that the choice of the formal language was very important as it determines what theses and with what accuracy are expressible in a given language. He was convinced that the formal language of classical logic enabled a precise recording of the theorems on "desirable accuracy." Its means are sufficient for symbolization (fundamental for a logical analysis), which is a formal record of the analyzed philosophical theses. In his analyses, Bocheński referred neither to non-classical logics nor, for example, to Leśniewski's systems (MORDARSKI 2014, 309–30).

Acceptance of the thesis on first-order logic gives rise to a question about other systems usually also called "logics". This question splits into two, namely 1) on the horizontal level – is classical logic the only logic, or the systems of so-called non-classical logics are logic too?; 2) on the vertical level—is first-order logic (with identity or without it) the only logic or higher-order logics are logic too?

[6] Also see ŻEGLEŃ 2001, 217–18.

[7] The naturalness of classical logic is referred to Theodore Sider (2011, 257).

[8] Quine especially emphasizes extensionality of logic, regarding it as a necessary, though insufficient condition of its full understandability (QUINE 1995, 90–91).

Quine's defense of the thesis on first-order logic is accompanied by criticism of non-classical systems. In those systems reinterpretation of the meaning of logical constants takes place. Criticism of modal logic, which—in his opinion—grew from a certain misunderstanding is commonly known. In his opinion, it is superfluous from the point of view of eligible aims of formalization.[9] Those objections conceal Quine's deeply rooted skepticism towards the concept of analyticity. In addition, he treats multi-valued calculi as theories that are only analogous to logic. Actually, they are uninterpreted abstract algebras (QUINE 1986, 84). At the same time, he speaks of the wish to reduce the scope of accessible questions to the possibilities of obtaining answers to them as a motive of the construction of intuitionistic logic.

Referring to the question about second- (and higher) order logics, Quine remarks that they carry much stronger ontological obligations, thus violating the rule according to which logic, as the most general science on reasoning, should possibly be ontologically neutral. Second-order logic is ontologically "commited"—in fact, it is "a set theory in sheep's clothing." In other words, Quine rejects the view that the calculus which enables quantification over variables which are not individual variables deserves the name of logic (QUINE 1986, 66–68). On the other hand, he speaks for the thesis that giving a precise criterion of being is possible only for the theories formulated in the language of extensional first-order logic (WÓJTOWICZ 2003, 370–71).[10]

2. JAN WOLEŃSKI'S COMPLETENESS AND UNIVERSALITY OF FIRST-ORDER LOGIC

Woleński is as eager a defender of the thesis of first-order logic as Quine. Like the American scientist, the Polish philosopher refers to the universality of logic, which is reflected in universal application, universal truth and topic neutrality[11]. Each science as well as the commonsensical knowledge assume and apply logical rules, consciously or not. Universal applicability of logic means that logical rules are so general that logical inferences behave completely indifferently towards different questions. Therefore, the second side

[9] According to Quine, the methodological status of modal logic as „hard" logic is rather doubtful. Contrary to classical logic, its limits are not clearly determined (QUINE 1976, 158–76).

[10] Ontological commitments of elementary theories (in the sense of Quine's criterion) are minimal since they oblige only to the existence of individuals, and not sets or relations.

[11] Earlier, this feature of logic was emphasized by Alfred Tarski.

of universal applicability of logic is its topic neutrality—logic does not privilege any concrete subject. Logical theorems are true in all circumstances, situations, states of the world, etc.

Woleński's considerations place the universality of logic on the metalogical level. To justify the thesis of first-order logic, he engages certain results of contemporary metalogic.[12]

The most important metalogical property of logic is, according to Woleński, semantic completeness. According to the contemporary semantic paradigm of logic, each logical calculus is a deductive system of tautology (logical truths). In a complete system, all tautologies expressed in its language are its theses. The theorem on completeness integrates the syntactic and semantic aspects of logic. The former is expressed in the definition of logic as a set of consequences of an empty set:

(1) $L = Cn\varnothing$ (or, equivalently $\varphi \in L \equiv \varphi \in Cn\varnothing$[13],

while the other is reflected by the semantic characteristic of logic:

(2) $\varphi \in L$ if and only if for every model M, φ is true in M.

It can also be said that the theorem on completeness is a bridge between syntactics and semantics, but also between the properties associated with those domains: universality and topic neutrality. Due to (1), logic is a part of any theory, i.e. it is contained in every set closed with operation Cn; therefore, it is universal due to inferential applications. On the other hand, due to (2), logic is independent of any detailed model. Thm on completeness establishes the relation between (1) and (2):

(Thm on completeness) $\varphi \in Cn\varnothing$ if and only if for every model M, φ is true in M.

This theorem establishes the equivalence of both approaches: logical theorems are a consequence of an empty set of sentences (i.e. they are a part of each theory) if and only if they are universally valid (true in every model)

[12] The property of universality of logic and the questions associated with it have been discussed since ancient times, also in connection with traditional logic; however, it was not until the beginning of the 20th that scientists achieved "hard" results in the form of proper metalogical theorems (Woleński 2014, 45–54).

[13] It looks clearly artificial or even strange at first glance, and empty set looks here like a convenient metaphor. In particular, one might argue that we can prove something from the empty set of assumptions just because an amount of logical machinery appears in axioms for *Cn*. The question arises as to how to justify that stipulations about the consequence operation are proper for logic.

and topic neutral. No detailed assumptions are necessary to obtain the laws of logic. It is also emphasized that Thm on completeness provides an argument to rebut the objections of circularity. Thanks to it, we know how to characterize "logically" without taking anything for granted as logical.[14] Another metalogical theorem, which is also a contribution in the formal description of the universality of logic, declares that logic as such does not distinguish any non-logical concepts (singular constant or predicate). It follows from it that logic does not favour any particular model or individual.

For many scientists, the argument for the thesis on first-order logic is the fact that first-order logic has the property of completeness on the ground of ordinary semantics—this theorem was proved by Gödel in 1930. The completeness theorem, on the other hand, is not valid for second-order calculus[15] or for modal logics.[16] The property of completeness of logic is important because in a complete system it is possible to prove all truths of this logic. In other words, the concepts of semantic consequence and syntactic consequence are equivalent in it. Therefore, complete logic best suits the main conceptual intuitions concerning logic and, in particular, shows the intuition that logic is universal (WOLEŃSKI 2004, 369–70). If a system is not complete, it is not a universal theory.

Universality of classical logic is connected with its simplicity. Woleński writes: "it is the most general, maybe because its world is the simplest." (WOLEŃSKI 2017b, 156). He gives a number of reasons from outside logic which speak for two-valuedness: binarity of biological rhythms, binarity of the genetic code, zero-one nature of information, dual behaviour of quantifiers, opposition of life and death, opposition: external-internal, etc. (WOLEŃSKI 2017b, 157–58).

Other metalogical theorems are also sometimes used to argue for elementary logic. It is pointed out that it has an effective (recursive) proving procedure (as opposed to second-order logic), it has the Löwenheim-Skolem property (if a set of sentences has an *infinite model,* then it has a countable *model), and it fulfils* Lindström's theorem (each compact logic[17] which has the Löwenheim-Skolem property is equally strong as first-order logic). How-

[14] Because the whole logical inference machinery is concealed in *Cn*, the axioms characterizing *Cn* requires justification (WOLEŃSKI 2017a, 25).

[15] A „full" view of higher-order logic coming from L. Henkin, is connected with the necessity of modifying standard semantics.

[16] These logics require additional extralogical limitations of models (WOLEŃSKI 2002, 217).

[17] In compact logic its set of formulas is non-contradictory when each of its finite sub-set is non-contradictory.

ever, an opponent of the thesis on first-order logic can also point to certain metalogical features which this logic does not possess. The examples are categoricity and decidability. It turns out that some pairs of features, e.g. completeness and categoricity are mutually exclusive, i.e. the completeness of a system is followed by its non-categoricity.[18] A negative consequence of completeness is Skolem's paradox (a thesis on the existence of strongly unintended models for the first-order theory).

It seems, therefore, that the philosophical and logical problem, namely if a given property of the system is a necessary condition of its logicality, should be distinguished from metalogical properties themselves. Some (including, for example, Woleński) consider the property of completeness such an important advantage (guaranteeing inclusion within the scope of systematization of all tautologies and—in case of a stronger version of the theorem on completeness—all rules of deduction) that they seem to attribute to it the role determining the logicality of the system. There are, however, some (e.g. Andrzej Biłat) who claim that categoricity is more important than completeness and that is why they assume that second-order logic is the basic system of logic.[19] That is the reason why it seems that philosophical 'weighing' of the importance of metalogical features must take place due to a definite aim.[20]

A conviction is quite common among philosophers of mathematics that first-order logic pays a high price for possessing metalogical properties (especially, including completeness), for its universality and a certain kind of 'elegance'. The price is a certain weakness of this system, namely a too little expressive power to define the basic mathematical notions in it, e.g. from the set theory (the concept of the finite set), analysis, topology, probability theory, etc. It is for this reason why higher-order logics are proposed.

The pragmatic argument referring to weak applicability of first-order logic in mathematics is put forward by Jon Barwise. He claims that elementary logic is insufficient "from the perspective of the mathematician from the street" and, therefore, limiting oneself to it decreases the chances of understanding many notions appearing in science and in our description of reality. Besides, this limitation does not find any justification in scientific practice. Hence the postulate not so much to reject first-order logic but

[18] On the ground of standard semantics, first-order logic is noncategorical (it does not provide a unique definition—with the accuracy to isomorphism—of concepts, e.g. the concept of the natural number) as opposed to second-(and higher-)order logic.

[19] For ontology, the property of categoricity is the more important of the two (BIŁAT 2004, 34–35).

[20] This problem is dealt with by Leslie H. Tharp (1975, 1–21).

rather enrich it with the means of the extended model theory. A scientist should then be guided by the directive of maximalizing the effectiveness of the description of a given structure which gives them freedom in creating new notions. That is why—according to Barwise—it is not possible to return to the thesis that first-order logic is logic (BARWISE 1985, 23).[21]

The possibility to depart from the thesis on elementary logic is explainable by referring to the philosophical assumptions concerning the role and status of logic. These are connected with the establishment of where the border between logical and extralogical terms lies. Shapiro distinguishes two basic points of view on the tasks of logic, namely 1) logic should formalize reasoning in science; 2) logic should formalize the concepts used to describe and characterize structures, especially mathematical structures. To realize the first task, elementary logic seems sufficient, while stronger means of expression need to be applied to describe mathematical structures, e.g. assuming that relation '$\in$' is a logical term.[22]

It is known that first-order logic seems to be composed of three segments where each next one is an extension of the former: (1) classical propositional logic; (2) first-order logic without identity; (3) first-order logic with identity. The expressive power of those systems grows from (1) to (3) but other metalogical properties disappear. (1) is complete semantically, complete in Post's sense, and decidable. $(1)+(2)$ and $(1)+(2)+(3)$ are neither complete semantically, nor complete in Post's sense, nor decidable. If we assume that decidability is a decisive property, then only the propositional calculus (and, possibly, a certain fragment of predicate calculus) will remain logic. It seems, however, that the most important metalogical property possessed by (1), $(1)+(2)$ and $(1)+(2)+(3)$ is the semantic completeness.

It also deserves to be mentioned that the status of identity is a disputable issue. On the one hand, identity behaves like truth functors and quantifiers in the sense that it fulfils the main metalogical theorems, i.e. on completeness, on compactness as well as Löwenheim-Skolem's and Lindström's. On the other hand, the disputable character of identity becomes visible in the fact that it enables the definition of so-called quantitative quantifiers, which seem to introduce an extralogical element.[23] According to Quine, the problem is in

[21] Similar views are shared by Gila Sher and Stewart Shapiro.

[22] The second task is assigned to logic by Barwise, among others.

[23] Those quantifiers can be defined according to the scheme „there are exactly *n* objects", where *n* is any natural number. This enables the formulation of true propositions in some models and in some it does not, depending on their number, e.g. "there is only one object" is true only in a one-element model.

fact only seeming since the majority of logicians are not concerned about whether first-order logic with identity or without identity is actually logic (QUINE 1986, 61–62). Woleński and others accept the thesis on first-order logic with identity.

According to Woleński, in three different segments of elementary logic the property of "being logical" has different intensities so one can speak of different degrees of logicality. This degree is connected with the relation that takes place between syntactics and semantics. Although the theorem on completeness establishes equivalence of those levels for all first-order logic, this harmony does not concern all features of a given logic. Metalogical properties, namely decidability and completeness in Post's sense decide that semantics of classical propositional logic can be fully replaced by the syntactics of this system. Truth tables can have both syntactic and semantic interpretations. The same cannot be said about predicate calculus. That is why a purely syntactic characterization of logic is adequate only in case of propositional logic, beyond which semantics has priority over syntactics. This priority of semantics towards syntactics is a general consequence of Gödel's and Tarski's limitation theorems (WOLEŃSKI 2002, 219). The degree of logicality, measured by the syntactic expressibility of semantic properties, is the largest in propositional logic, smaller in predicate calculus, and still smaller in predicate calculus with identity. Since "being logical" is a special instance of "being formal", the classical propositional calculus is the most formal (WOLEŃSKI 1999, 25–35).

3. STANISŁAW KICZUK'S LOGIC OF THE REAL WORLD

The exceptional position of classical logic is justified in another way, which can be in summary called the ontololgical-semantic one, by Stanisław Kiczuk[24]— a philosopher and logician from the Lublin school. Like Quine and Woleński, he emphasizes the general universal character of the laws of classical logic.

[24] Kiczuk's first work, which aimed to justify the classical propositional logic — " Zagadnienie obowiązywalności klasycznego rachunku zdań" [The problem of bindingness of the classical propositional logic] — is from 1988. The Author came back to his problem after over twenty years, formulating a more radical version of the view expressed earlier. The articles "Skąd logika czerpie swoją moc?" [Where does logic draw its power from?] (= KICZUK 2009) and "O niektórych prawach logiki i zasadach ogólnej teorii bytu" [On some laws of logic and the principles of the general theory of being] (= KICZUK 2012) give philosophical reasons for the bindingness of classical logic.

According to Kiczuk, each non-classical logic, especially each logic which is cognitively valuable for physics, i.e. whose all theses are true in physical interpretation, is an extension of classical logic and arises from the latter by introducing new symbols to the dictionary, in particular, certain non-extensional constants. Kiczuk gives two complementary arguments to support the thesis on the validity of classical logic (TKACZYK 2008, 19). The first one refers to Werner Heisenberg, who distinguished two languages of contemporary physics (or, more specifically quantum mechanics), namely the language of mathematics and the imaginary language. Using the language of mathematics (called the mathematical scheme), the relations occurring between the phenomena in nature are described in the form of equations. However, this language is insufficient to imagine the quantum world, especially two interconnected things: wave-particle duality and the uncertainty principle[25]. That is why, according to Heisenberg, physics needs another, richer language basing on and close to the natural language, also referring to the fragments of some philosophical theories. Kiczuk remarks that non-classical logics can also be the logic of the imaginary language but only those which arise by extending some system of classical logic with proper non-extensional functors. Because the mathematical scheme is the proper part of the imaginary language, a candidate to be a logic of the imaginary language must comprise all theorems expressible in the mathematical scheme, whereas mathematics, which constitutes the basis of quantum mechanics, is only classical mathematics based on classical logic. Therefore, no deviant logic can be the logic of the imaginary language of contemporary physics. Besides, Kiczuk points out that the choice of classical logic is determined by the very nature of physics, which — like classical logic — is a science on the ontological way of viewing reality. It grew of Aristotle's physics as a result of limiting the field of inquiries (KICZUK 1984, 131).

The argument for the thesis on the bindingness of classical logic is the argument referring to the assumptions of realistic ontology. It also provides justification to the thesis according to which the mathematical scheme of physics is based on classical logic in a significant, and not only accidental (e.g. as a historical coincidence) manner. Kiczuk focuses on the propositional logic since he believes that principal differences between classical logic and non-classical logic are visible already on this elementary level.

[25] An idea was born in the face of the results of quantum mechanics to revise classical logic and build so-called quantum logic (KICZUK 1988a, 57–75).

There is a possibility to justify philosophically the bindingness of the leading (i.e. most frequently criticized and undermined by the advocates of non-classical logics) laws of the classical propositional calculus, and — indirectly — to justify the whole of this calculus. Within the field of realistic ontology, it was as early as in ancient times when certain rules were formulated whose content specified the primary data referring to being, e.g. that each being is a definite existing content, that there are at least two different beings, that there is at least one changeable being, that each being has the reason for its existence within itself or beyond it. These are, for example, the following rules: identity, noncontradiction, determination (excluded middle), double negation, or sufficient reason. In the general theory of being they are unprovable and are named the first principles in being. A lack of proof, however, does not mean a lack of justification. Justification of those principles takes place by way of intellectual analysis in constant contact with reality (KICZUK 1988b, 51).

The ontological principle of noncontradiction, which was distinguished by Aristotle the Stagirite, is formulated differently: "being is not non-being", "it is impossible for something *to be* and *not to be* at the same time", "it is impossible that something should simultaneously be and not be", "it is impossible that when a thing exists in something that it also does not exist in that thing in the same respect", "it is not true that a thing possesses feature *C* and it does not possess it in the same respect". The principle of determination (excluded middle), on the other hand, can be formulated in the following way: "each being exists or it doesn't exist", "each being is a definite existing content or it is not a definite existing content". These expressions show that ontological principles of noncontradiction and excluded middle reflect truth-functional relations of 'disjuncture' and 'non-disjuncture' of two contradictory states. Those and other philosophical principles (e.g. the principles of identity and double negation) remain in proper relations with the relations between facts stated by means of truth functors of classical logic (KICZUK 2012, 175).

The laws of excluded middle and noncontradiction seem most characteristic of the classical propositional logic and they aspire to be named its first principle although not in the sense of being its principal assumptions. They are not suitable to be the axioms due to the deductive weakness. As the most primary principles they are an object of criticism by the advocates of deviant logics, especially many-valued, intuitionistic and paraconsistent ones. Those logics cannot be justified by referring to realistic ontology. It is so because all states of things are *obedient* to the law of noncontradiction and the law of excluded middle, while the systems which are in some sense many-valued (either in the form of truth-value glut or truth-value gaps) in which they do not bind, do not present any value from the point of view of a description of the world (KRASZEWSKI 1967, 257–58)[26].

Therefore, certain first philosophical principles and the related laws of logic state the same, most general, objective relations between the corresponding facts (state of things), which – in the language used by Kazimierz Ajdukiewicz — constitute “the logical structure of the world, the logic of things” (AJDUKIEWICZ 1960, 5–6)[27]. Bolesław Sobociński writes that reality is such, the world surrounding us is such that it enforces the classical propositional calculus (SOBOCIŃSKI 1956, 31). The force of logic streams from reality, i.e. the laws of classical logic state the most general relations which occur in reality (KICZUK 2009, 648). A similar thesis is also arrived at by contemporary researchers looking for so-called fundamental logic. The latter turns out to be a formal system best suited to the reality whose basic structures are classical (SIDER 2011, 278).

Referring to the texts by Ajdukiewicz, Sobociński and Grzegorczyk, Kiczuk justifies the relation between standard logic and the classical concept of truth. The classical definition of truth divides the class of all constative sentences into the subset of sentences compliant with the “being” — true ones, and incompliant with “being” — false ones. This definition determines the basis of the dichotomous division of sentences, which can be treated as the starting point for two-valued logic (GRODZIŃSKI 1989, 32).

The rule of bivalence is implied by jointly treated logical laws of noncontradiction (also known as the law of contradiction) and excluded middle. On the ground of propositional calculus the rule of noncontradiction states that out of two contradictory states of things one does not exist and (on the ground of the classical concept of truth) it is equivalent to the metalogical law of noncontradiction, which states that out of two contradictory sentences one is false. The law of excluded middle states that out of two contradictory states of things one exists, and its metalogical version ascertains that out of two contradictory sentences one is true. Therefore, the rules

[26] According to Jacek J. Jadacki, the view that the world is built not against the principle of excluded middle and the principle of noncontradiction can be hardly ever encountered (JADACKI 1985, 125).

[27] This type of realistic view on logic is also represented by Arthur N. Prior. According to him, “logic is *not* primarily about *language, but* about the *real world”* (PRIOR 1996, 45).

of noncontradiction and excluded middle are fundamental to the objective reality (i.e. existing irrespective of the cognitive subject).

Basing logic on the corresponding definition of truth as the correspondence of the sentence with reality means adopting the ontological cognitive perspective. Its core is strong objectivity, i.e. the view that something exists in a way which is independent of our cognitive processes, this something is a domain directly referred to by human convictions, and the truth of those convictions of definite content depends on what exists in such an objective way.

For the ontological research perspective binarism is necessary since the *adequatio* relation cannot undergo gradation. There is nothing indirect between *adequatio* and a lack of it, like in the case of contradictory states of things. The sentence has an objectively defined logical value, depending on reality, and independently of our abilities to recognize this value, and especially of the possibilities of proving the proof. Using the language of Hilary Putnam, truth understood in this way is Truth "from Divine Point of View" (PUTNAM 1997, 33). Non-classical logics, on the other hand, are connected with some non-ontological, epistemological research attitude. They give up the concept of truth dependent only on reality. Truth in those logics is immanent towards our human cognitive activities[28].

4. CLASSICAL METALOGIC OF NON-CLASSICAL LOGICS

Classical logic also finds support from metalogic. The classical extensional metalanguage is special and it served to analyze different kinds of non-classical logics. The argument that classical logic rules in fact absolutely is provided by the metalinguistic practice (MAKINSON 2005, 14). Saul Kripke built semantics for model logic in a non-modal, extensional language. Jan Łukasiewicz described his many-valued logics in classical metalogic. Reasonings on non-classical logic are conducted using two-valued logic, even those of its rules which are questioned by a given object logic. Semantics of intuitionistic logic was provided by Saul Kripke and Evert W. Beth, also within classical meta-theory.[29] There is no trouble with des-

[28] For example, in intuitionistic logic one cannot make use of the concept of truth concerning mathematical sentences irrespective of the concept of proof.

[29] That is why some argue that if someone makes use of classical metalogic, they are classic logicians, for whom so-called non-classical "logics" — if they are not but an intellectual game — are exercises in applying logic to certain special activities, e.g. database management (READ 2006, 207).

cribing intuitionistic logic from the classical point of view. We conclude in this respect that certain laws of classical logic (e.g. excluded middle, strong law of double negation) are not valid in intuitionistic logic. On the other hand, reverse comparisons are problematic because intuitionists 'do not understand' the classical formulas which they reject.

The problem of classical metalogic for non-classical logics appears in the context of the dispute about pluralism in logic. ZoltánVecsey put a question on the basis of which logic argumentation which is to prove the thesis on logical pluralism in the version by J.C. Beall and Greg Restall should be accepted. Stephen Read answers that this pluralism arose from „combining a non-classical theory with a classical metatheory" (Read 2006, 205). However, he asks a question if on the object level the same logic which is used on meta-level should be considered as special[30]. In his opinion, non-uniformity of the object language and meta-language is analogous to a split personality. He adds that the debate on monism and pluralism in logic is conducted in classical logic.

CONCLUSIONS

Classical logic occupies a special place in the family of the possible logical systems. It is a universal, fairly rich and relatively simple tool to analyze philosophical assumptions of scientific theories, a model of inferences in the area of philosophy, exact sciences and everyday discourse. Its advocates especially refer to such features as completeness (all tautologies of its language are its theses), minimal ontological assumption (it does not oblige for the existence of properties or relations), and a wide range of applications. Standard logic is the basis of formalization of a number of important mathematical theories, especially Peano arithmetic and Zermelo-Fraenkel set theory, and it is the meta-logical basis of nearly all contemporary logical research.

The thesis on the bindingness of classical logic is rationally justified in each of the discussed ways. The question to be posed is if classical (elementary) logic should be considered the only proper logic.

[30] Read thinks that while referring to modal logic it can be understood that meta-theory is nonmodal and extensional, or even that metalogic of intuitionism is classical, the attitude of advocates of relevant logic is strange — it is an expression of intellectual schizophrenia.

The most restrictive approach, in the sense that it does not allow for other logics except for canonical logic, is represented by Quine. Adopting any other logic would mean mutilating the science which has based on classical logic for over two thousand years. A more liberal concept is advocated by Kiczuk, who recognized a need for non-classical logic of the imaginary language of physics, with such logic being an extension of the classical propositional calculus and fulfilling definite conditions of adequacy. Likewise, Woleński seems to claim that the arguments for classical logic do not wholly depreciate non-classical logics, which in certain cases provide more subtle methods of analysis than standard logic. It does not, then, exclude the possibility of their local application (e.g. to analyze constructive evidence in mathematics, fuzzy concepts, or sentences about the future). On the other hand, he does not recognize higher-order logics.

In spite of the fact that Quine does not recognize a need for other logics except for classical logic, he gives a hint how to construct such logics. The point is that natural language, together with its connectives, is ambiguous while a logician chooses one of the meaning variants of a given connective and assigns a precise meaning to it. Kiczuk (and, possibly, Woleński) is convinced that truth functors do not suffice to linguistically express all logical relations that occur in the world. The natural language, and the languages of a number of sciences contain connectives which are not included within the classical propositional logic and whose formal view would make it possible to express thoughts precisely and to draw conclusions.

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ON FOUR TYPES OF ARGUMENTATION FOR CLASSICAL LOGIC

Summary

My goal of this article is to analyze the argumentation lines for the correctness of standard logic. I also formulate a few critical and comparative remarks. I focus on four the most coherent and complete argumentations which try to justify the distinguished position of classical logic. There are the following argumentations: Willard van O. Quine's pragmatic-methodological argumentation, Jan Woleński's philosophical-metalogical argumentation, Stanisław Kiczuk's ontological-semantic argumentation, argumentation based on metalogic. In my opinion, the thesis concerning the correctness of classical logic is rationally justified by these argumentations. The problem remains whether the analyzed standard logic is the only proper logic.

Keywords: first-order thesis; maxim of minimum mutilation; universality of logic; logic of things; metalogic; W.v.O. Quine; J. Woleński; S. Kiczuk.

O CZTERECH TYPACH ARGUMENTACJI NA RZECZ LOGIKI KLASYCZNEJ

S t r e s z c z e n i e

Moim celem w tym artykule jest analiza argumentacji pod kątem poprawności standardowej logiki. Formułuję też kilka uwag krytycznych i porównawczych. Skupiam się na czterech najbardziej spójnych i kompletnych argumentach, które próbują uzasadnić wyróżnione stanowisko logiki klasycznej. Istnieją następujące argumenty: argumentacja pragmatyczno-metodologiczna Willarda van O. Quine'a, argumentacja filozoficzno-metalogiczna Jana Woleńskiego, argumentacja ontologiczno-semantyczna Stanisława Kiczuka, argumentacja metalogiczna. Moim zdaniem teza o poprawności logiki klasycznej jest racjonalnie uzasadniona tymi argumentacjami. Pozostaje problem, czy analizowana logika standardowa jest jedyną właściwą logiką.

Słowa kluczowe: teza o logice I rzędu; maksyma minimalnego okaleczania; uniwersalność logiki; logika rzeczy; metalogika; W.v.O. Quine; J. Woleński; S. Kiczuk.