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Conjectures and Metalogical Rules

Abstract

This article compares Popper's position [in Conjectures and Refutations] on the ontological status of logical rules of inference with his position [in The Logic of Scientific Discovery] that falsification, as part of scientific methodology, is in accordance with the logical rule of modus tollens. It is shown that Popper's criticism of Kyle's standpoint about logical rules as procedural rules, which we can only discover, is persuasive. Popper's standpoints are criticised in relation to following question: Is it possible to understand a logical rule as a form of formal logical implication and to determine additional criteria of truth conditions of the logical rule of inference?

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Having started with the critics of Kyle's standpoint (Conjectures and Refutations) according to which the problem of applicability of the calculus of logic and arithmetic is reducible to pseudoproblem, Popper mentions the following "classical" standpoints about the nature of logical rules:[1]

(A) The rules of logic are laws of thought.

(A1) They are natural laws of thought - they describe how we actually do think; and we cannot think otherwise.

(A2) They are normative laws - they tell us how we ought to think.

(B) The rules of logic are the most general laws of nature - they are descriptive laws holding for any object whatsoever.

(C) The rules of logic are laws of certain descriptive languages - of the use of words and especially of sentences.

I think that the question about the nature of logical rules belongs to the kind of epistemological questions in the way similar to the way the physical question

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[1] Logical rules are rules of inferences, and in the metalogic. Much of Popper's paper is about the nature of logical rules. We can call it "metametalogical" status of logical rules, too.

about the nature of light also belongs. That is, to understand analytically and explain theoretically means to determine epistemologically. What is special with epistemological determination of the rules of logic reflects just in analytical understanding, as the very analysis of the fact of existence of logical rules we perform sticking to these rules themselves. The motive and the way of demonstrating in favor of any thesis about the nature of logical rules might come directly from the model of symbolic language or indirectly using these models either in mathematical or in the theories of natural sciences. Therefore, I think that Popper's discussion of Kyle's question "Why are the calculi of logic and arithmetic applicable to reality?" primarily belong to the effort of determining of epistemological status of the rules of logic. Following Popper's standpoints, I will try to show in the rest of this paper how the same questions lead towards one possible determination of the ontological "source" of logical rules.[2]

I.

The rejection of the justification of Ryle's reduction of the aforementioned question to the pseudoproblem Popper achieves using the difference between metalogical applicability of the logical rule and the corresponding formula, which is given inside a logical model (by means of which we are able to express the conclusion about relations and about individuals). For example, for the model of the logic of propositions the corresponding formula, which relates to the modus ponens, reads as follows:

Logical rule	Corresponding formula
p	
If p then q	$[p \wedge (p \Rightarrow q)] \Rightarrow p$
q	

Having agreed with Ryle's standpoint about logical rules as procedural rules, meaning their being usable for deduction of logical consequences, Popper cogently stresses the difference as to the usage status of the logical rules in

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[2] See: Mirko Jakid, "Has Logic any Ontology", Synthesis Philosophica 33 (1/2002), pp. 211-223.

relation to the corresponding formulas of the logical models. The corresponding formulas of the logical models are the statements that conditionally determine something about all the relations and individuals of the certain kind. Logical rules unconditionally determine something about all the statements of the certain kind. The descriptive role of the logical models and the metalogical role of the logical rules Popper additionally stresses by the following features exemplifying the difference between logical rules and corresponding "if...then" formulas:

(1) Logical rules are always statements about statements.

(2) Logical rules are unconditioned statements of deductive inference.

(3) The rule of inference, after variables being replaced by constants, determines the validity of certain conclusion.

(4) Logical rules are never used as premises of the conclusions that are made in accordance with them.

(5) Corresponding "if...then" formula is used as a premise of the conclusion.

(6) Corresponding "if...then" formula leads into the logical truism.

(7) Endless number of corresponding hypothetical formulae by means of logical rule of inference can be deduced from just a few formulae of a logical model.

Popper's agreement with Ryle's standpoint is based just on these distinguished differences between usage of the logical rule of inference and the corresponding subset of formulae expressed by means of symbolic means of logical models (for example, the logic of propositions or logic of predicates). Namely, in the case of our non-perceiving (or neglecting) of these differences we would reduce the logical rule of inference on the subset of formulae of logical models. Because of their descriptive role in determining relations and properties of individuals of the certain kind, the fundamental question about the nature of the logical rule of inference could not be raised at all. The problem would be reduced only on the question of descriptive acceptability of the symbolic means of logic in describing a certain factual state of things.

But, the very acceptation of the usage difference between the logical rule of inference and the corresponding subset of the formulae of logical models does not preclude the possibility of reduction of the applicability question of the logical rules of inference to the pseudoproblem. Namely, if we accept the

logical rule of inference as the procedural rule about valid inferring in which from true premises, using the rules, we without exception, come to true conclusion, even regardless, of the kind of language in which we by means of our premises truly described a certain state of things, and then this "nondescriptive" role of the logical rule of inference wrongly connect with the question "Why do the rules of logic fit the things and the facts of our world?" - the question of applicability of the rules of inference to reality reduces to a pseudoproblem. "Nondescriptive" role of the logical rule of inference here means deductive inferring of consequences, so that the procedural rule of inference has not the descriptive role of the linguistic means which conforms fitting description of the state of things in, for us, really existing universe. Popper's rejection of the reduction of the question about the nature of the logical rule of inference onto pseudoproblem and its new rising onto the epistemological level has been achieved by the question "Why are these rules useful?", in which way we in a different way ask for the reason of their applicability to reality.

I think that the attempt of determining reasons of applicability of the logical rule of inference to reality, and the attempt of giving answers for the question about the nature of it is at the same time the attempt of determining of epistemological status of the logical rules of inference. Under the concept of epistemological status of logical rules, I do not think the role logical rules play in comprehension, but I think their possible source. Namely, if we entitled to ask for the reasons of applicability and about the nature of logical rules of inference, we also meaningfully can ask: "What is the source of the logical rules of inference?".

In the following text I will try to give some possible philosophical determinants inside which I hope would be possible to try answers to these questions. Following Popper's questions, if I understood them correctly.

II.

Popper's looking for answers to the question of successful application of the logical rule of inference, that is, his discovering of the reasons of success of the application of this rules to reality, can be determined by means of analysis of his critic of the aforementioned "classical" mutually inconsistent (A, B, C) standpoints about the nature of logical rules, in combination with his direct

answer to the question about successful application of the logical rules of inference. The standpoint (A) indirectly criticizes disclaiming its stronger variant contained in the standpoint (A1). Namely, the fact that a rule appears to be true, convincing, compelling, self-evident, etc., is not the sufficient reason to show it should be true. Popper warns that the opposite is possible - the truth of a logical rule might be the reason of its appearing true or convicting. To put it differently, the criterion of truthfulness of a logical rule is not its self-evidence or self-understandingness, but its truth can be the criterion of the rationality of its acceptance. By this thesis turning concerning the criterion of rational acceptance of a logical rule Popper made a step forward to the determination of the criterion of accepting logical rules in accordance with their possibilities and results of their "empirical" corroboration. As the logical rule of inference (modus ponens, for example) consists in itself one hypothetical part, and the concept of truth gets the central place in the possibility of its reasonable acceptance, any case where this logical rule is applied to reality, in its hypothetical part gets the form of material conditional. At the same time, Popper achieves the possibility of assessing the question of the usage acceptability of the logical rule of inference inside of his falsificational suggestion in the methodology of scientific research. Popper's critic of (A1) consequentially leads to the standpoint (B). Popper shows the other possible criticism of (A1) which leads to (A2). Namely, from the unacceptability of reasoning which is not in accordance with the rules of logic, which we usually call "logical error" we can affirm our resolution towards avoiding break of logical rules if we wish to formulate or deduce true statements. These true statements generally represent the true description of facts. The direct description, in the case of the usage of the formulae inside logical models, together with indirect statement deduction from these true premises (described by means of logical model) using the logical rule of inference. His criticism of (A1) through (A2) really leads to (B).

But, the standpoint (B) Popper criticize as unsatisfactory using the difference between descriptive role of the formulae of logical models and meta-logical role of the usage of the logical rule of inference, that is, he uses the fact that logical rules are not used in descriptive way representing the direct

description of a certain state of affairs in reality. As procedural rules the logical rules can in no way be reduced to descriptive statements of any description of any state of affairs in reality. As the standpoint (B) encourages the role of logical rules as descriptive laws representing the adequate description of the worldly facts Popper expresses his third reason for the criticism of this standpoint.

"Thirdly, because any theory which does not allow for the radical difference between the status of a physical truism (such as 'All rocks are heavy') and a logical truism (such as 'All rocks are rocks' or perhaps 'Either all rocks are heavy or some rocks are not heavy' must be unsatisfactory. We feel that such a logically true proposition is true not because it describes the behaviour of all possible facts but simply because it does not take the risk of being falsified by any fact; it does not exclude any possible fact, and it therefore does not assert anything whatsoever of any fact at all. But we need not go here into the problem of the status of these logical truisms. For whatever their status may be, logic is not primarily the doctrine of logical truisms; it is, primarily, the doctrine of valid inference."[3]

Here, it is to be noticed that Popper calls attention to the difference between general descriptive usages of truisms of logical models (logic of proposition, for example) and truisms of physical nature. Namely, regardless whether it is the case of logical truisms that represent axiomatic schemes of logical models usable in demonstrative procedures of the mathematical models (theory of numbers, for example), or it is the case of truisms representing the formulae of a logical model that correspond to the conclusions reached in accordance with logical rule of inference, it is always the case of usage of symbolic tools of logical models in mathematical theories or on individual states of affairs in physical reality. On the contrary to this, in the cases of physical truisms, it is the descriptions on the basis of wider context of physical theories, which investigate physical reality through fitting descriptions.

In what follows I will try to show the need to get into the problem of the status at least one logical truism (the logical principle of identity) in order to give

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[3] Karl Popper, Conjectures and Refutations, Routledge and Kegan Paul, London 1963, p. 207.

some marks for the possible philosophical field in which to search for the answers of the question of the source of logical rule of inference.[4]

After having mentioned Tarski, Popper criticizes standpoint (C) withholding the concept of truth as a central semantical concept of logic which does not allow the possibility of reducing logic to symbolic inscriptions with no meaning at all. Popper is right when he claims that in the case of taking logical inscriptions as sequences of symbols without meaning, we not only cannot speak about the truth or falsity of such sentences which are expressed in symbolic language, but also cannot speak about usability of the logical rule of inference, because this rule does not exist at all in the sense of valid deductive inference of true conclusion from true premises. In other words, inasmuch as the concept of truth is semantically empty, it is senseless to talk about the usage of the logical rule of inference in the sense of inferring true conclusion from true premises, that is, the question about the reason of validity or usability or successfulness of this rule is no more possible. I think that for the additional support of Popper's criticism, we can mention the fact that fundamental logical operators are defined through their truth tables on the principle which in no way allows the possibility for the concept of truth in them to be semantically empty (that is, without meaning). Even in the Hilbert type of formalism, the sequence of symbols, which contains symbols of logical operators too and with no exemption, contains them defined by their truth tables. Popper, of course, with this criticism of (C) standpoint did not try to affirm the absolute independence of the logical rule of inference from linguistic utterances or linguistic systems. Namely, inasmuch as we look at the models of contemporary logic as linguistic systems expressed by means of special symbolisms, we perceive that the possibility of usage of the logical rule of inference in certain measure depends on capabilities of symbolic logical models. Popper gives one example to which I will refer here as "Rachel Example".[i]

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[4] "The source of the logical rule of inference* does not necessary mean any kind of historical origin of the logical rule of inference. Philosophically speaking; it means the ontological source of the logical rule of inference (for example, mind or "extramind" reality, or correspondence between them).

By means of instantiation in natural language we get the sentence "If Rachel is Richard's mother and Richard is Robert's father, then Rachel is Robert father's mother and his paternal grandmother". If we put this sentence as a premise of the argument on which we really apply the logical rule of inference, for example modus ponens, then the other premise reads "Rachel is Richard's mother and Richard is Robert's father", and the conclusion reads as "Rachel is Robert father's mother and his paternal grandmothers The problem of the relation between "father's mother" and "paternal grandmother" is resolved inside of the logic of predicates with identity insofar as family parentage relations bound the reach of this relation.[5]

I also should agree that the logical rule of inference used in any linguistic system always leads from true premises to true conclusions. The reason for this Popper sees in the way we have defined the logical rule of inference. In other words, there are no alternative logics in the sense that their rules of inference would lead from the true premises to false conclusion, having defined "the rule of inference" in such a way for it to be impossible. Following this Popper's standpoint it is possible to put the following question: "Inasmuch as the formulation of the logical rule of inference is a matter of definition, does it open the possibility of conventionalism in the interpretation of the understanding of the logical rule of inference?" We can ask the same in this way: "Couldn't we by defining the logical rule of inference in some other way establish a different rule (rule with different properties) we would call the logical rule of inference?"

Popper's answer to this is negative, but it is nevertheless possible to ask: "What makes it necessary to define the logical rule of inference the way it has been defined?"

Popper's negative answer to the former question mirrors itself in somewhat different form when we put it into the context of his overall philosophy of

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[5] Universe of discourse (U. D.): in addition with the properties of transitivity, symmetry and reflexivity of the identity.

scientific method. Namely, Popper (Logic of Scientific Discovery) the falsification of scientific theories sees as modus tollens of the classical logic.[6] On the other hand, the definition of the logical rule of inference (as modus tollens, for example) does not permit the possibility of falsification. If the definition of the logical rule of inference depended on purely conventional agreement any kind of epistemological attitude, including the falsificational one, would become questionable.

III.

The logical rule of inference (modus ponens, modus tollens) includes, par example for prepositional logic, the formal logical implication defined by its truth table.[7]

If we could define the properties of the logical rule of inference in some other way we than usual one, the only candidate to enable different definition of this rule would be differently defined truth table for logical implication. But, the proofs for four deducible correspondent relations of the truth table for logical implication demand the usage of the following theorems: deduction theorem, theorem of the elimination of implication, reductio ad absurdum theorem, and weak negation elimination theorem. The proof for any of these theorems demands the usage of the logical rule of inference (modus ponens). Now, we meet the problem of determining the epistemological status of the logical rule of inference in another form. Namely, for the proof of deductive acceptability of the truth table for logical implication we have to use the theorems, which as

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[6] "The falsifying mode of inference here referred to - the way in which the falsification of a conclusion entails the falsification of the system from which it is derived - is the modus tollens of classical logic. It may be described as follows: Let p be a conclusion of a system t of statements which may consist of theories and initial conditions (for the sake of simplicity I will not distinguish between them). We may then symbolize the relation of derivability (analytical implication) of p from t by 't$\Rightarrow$p' which may be read:' p follows from t'. Assume p to be false, which we may write '~p', to be read 'not-p'. Given the relation of deducibility, t$\Rightarrow$p, and the assumption ~p, we can then infer ~t (read 'not-t'); that is, we regard t as falsified. If we denote the conjunction (simultaneous assertion) of two statements by putting a point between the symbols standing for them, we may also write the falsifying inference thus: ((t$\Rightarrow$p)• ~p)$\Rightarrow$ ~t, or in words: 'if p is derivable from t, and if p is false, then t also is false'." Routledge 1992, p. 76.

part of their proof contain the logical rule itself, and this rule in its premise contain logical implication defined by belonging truth table. What remains is only intuitive acceptance of the sentences, which in natural languages might read:

- Truth cannot logically non-contradictory imply falsity.

- From falsity logically follows anything.

I think that the intuitive cogency of the firstly mentioned sentence is based on the inevitability of the general notion of identity, which in the natural language can be expressed by the sentence "Anything is identical with it-self". This notion of identity shows its inevitability especially in dealing with mathematical entities or elementary sentences of logical models, which are the truth functions of themselves. In dealing with spatio-temporal entities of physical reality, I think that the inevitability of the concept of identity becomes obvious in the standpoint Popper especially holds:

"Facts are something like a common products of language and reality; they are reality pinned down by descriptive statements."[8]

I think that violating identity we would not be able to distinctly epistemologically determine any kind of fact. The problem of "essential" properties in this case is a matter of demanded level of description. Namely, the demanded level of description gives successful answers to the questions as: "What makes a man to be a man", "What makes Socrates a man", etc. In the case of elementary sentences of logical models whose only property (and, therefore, only "essential" property) is the property of truth and falsity, the comparison of their mutual relation of the logical implying is governed just by inevitableness of the general concept of identity.[9]

To put the other way, in order to accept a sentence which says that truth cannot logically non-contradictory (truly) entail falsity forces the general

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[7] Variants of paraconsistent logic are out of our discourse.

[8] Karl Popper, *Conjectures and Refutations*, Routledge and Kegan Paul, London 1963, p. 214.

[9] We are able to express logical principle of identity ($A \Rightarrow A$) with the logical operator of incompatibility as $A|(A|A)$, which we may read: "A is incompatible with incompatibility of A with itself".

concept of identity. Truth, of course, logically (truly) entails truth. But, the secondly mentioned sentence might sound as convention. Namely, if falsity entails anything, we could in mutual logical entailment of the false elementary sentences of the logical models infer truth, but alib falsity. But, if some elementary sentence is false then it according to the logical principle of identity necessarily logically entails itself just owing to its falsity, and here again we follow the concept of identity in its being unavoidable. To put it the other way, if we would the fourth line of the truth table (antecedents and consequence also being false) would also be false. This way we would violate the concept of identity, necessarily.[10]

In so far the fourth line of the truth table for logical implication is not a convention, because we follow the logical principle of identity, which is founded on the concept of identity as unbreakable. Also, as the falsity of antecedents says nothing meaningful about thinkable logical entailment of the true consequence, it also cannot confer doubt the truth of mutual logical entailment of the truth of antecedents and the truth of consequence based on the concept of identity.

This result enables a different approach (A, B, C, for example) to the efforts of determining epistemological status of the logical rule of inference. If the concept of identity gives foundation to the logical rule of inference then the philosophical question whether the rules of logic are only the laws of thought which describe our only way of thinking or they are the most general laws of nature which describe any object stays open. To the classical aprioristic standpoint about the innateness of our ideas independently of any "empirical content* there is contrary standpoint about conditional innateness and relative apriority on the basis of empirical experience. To the classical aposterioristic standpoint there is contrary standpoint about corresponding relation between our mind and outside world. I think that the further development of this problem of determining epistemological status of the logical rules of inference

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[10] It is possible to express the difference between the concept, which I here descriptively call "the general concept of identity*, and the concept "the logical principle of identity" as the difference between the ontological "category" of identity and logical expression for identity. Of course, without the misinterpreted "Aristotelian" substantionalism.

will in future times be determined inside of these non-necessarily contrary philosophical theses. The contribution Karl Popper has made to these philosophical developments is really one of the greatest importances.

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[i] Analysis of the "Rachel Example":

"Rachel Example" expressed by natural language	"Rachel Example" expressed by symbolic tools of the model of categorical syllogisms
Rachel is the mother of Richard.	"A is b"
Richard is the father of Robert.	"C is d"
The mother of the father is the paternal grandmother.	"All e are f"
Rachel is the paternal grandmother of Robert.	"A is g"

Here, "A" and "C" stands for "Rachel" and "Richard", respectively. And "b" stands for "mother of Richard", "d" for "father of Robert*, "e" for "mother of the father", "f" for "paternal grandmother", "g" for "paternal grandmother of Robert".

Popper concludes that this kind of usage of the logical rule of inference is invalid because of the possibility of finding as many cases of counter-examples as we wish inside logic of categorical syllogisms, and then finally concludes that language, in spite of its maybe enough richness for the description of all facts we wish to describe, it does not necessarily mean that it enables the formulation of the logical rule of inference in the way it could cover all the cases in which we can from true premises come to true conclusion.

In "Rachel Example" Popper gets the conclusion on the basis of premise "The mother of the father is the paternal grandmother". In Popper's symbolic account this sentence reads as "All e are f". This is the case of generally valid sentence that we can express also as "Somebody who is somebody's father's mother is his/hers paternal grandmother". If we wished to differently call paternal grandmother, we would call her mother of the father.

It is not possible to imagine falsificational counterexample by means of we should be able to refute mutual equivalence of the sentences "The mother of the father is the paternal grandmother" and "The paternal grandmother is the mother of the father". The same situation is with its logical analytical consequence: "Whose mother is paternal grandmother is father". According to logical equivalence it follows: "The paternal grandmother is the mother of the father", and then, by necessity also "All f are e". Two sentences are mutually logically equivalent if and only if it is not possible that one of them should be true and another should be false. Namely, it is not possible consistently to accept one of them, and to refute another. The same sentence we can utter also as "Somebody who is somebody's paternal

grandmother is his/hers father's mother". In this context, analytically necessary valid is also the sentence "Whose mother is paternal grandmother is father*, but it is not possible to express this sentence by Popper's symbolic account, unless as: "All whose *b* are *f* are *d*".

The same sentence is expressible as: "Somebody whose mother is somebody's paternal grandmother is his/her father".

This is the set of generally valid sentences:

Somebody is somebody's mother.

Somebody is somebody's father.

Somebody is somebody's paternal grandmother.

Somebody who is somebody's father's mother is his/hers paternal grandmother.

Somebody who is somebody's paternal grandmother is his/hers father's mother.

Somebody whose mother is somebody's paternal grandmother is his/her father.

From this description of family relations containing three members we can by means of combining of instantiation and generally valid sentences deduce three quasi-conclusions of equal cogency and non-validity:

(1)

Rachel is the mother of Richard.

Rachel is the paternal grandmother of Robert.

Whose mother is paternal grandmother is father.

Richard is the father of Robert.

(2)

Richard is the father of Robert.

Rachel is the mother of Richard.

The mother of the father is the paternal grandmother.

Rachel is the paternal grandmother of Robert.

(3)

Rachel is the paternal grandmother of Robert.

Richard is the father of Robert.

The paternal grandmother is the mother of the father.

Rachel is the mother of Richard.

That this is really the case of description and not of conclusion where the logical rule of inference is used can be shown using symbolic tools of the prepositional logic. For example for original "Rachel Example":

U.D.: family parentage. Mxy: y is the mother of z. Oyz: y is the father of z. Pxz: x is the mother of the father of z. Bxz: x is the paternal grandmother of z.

$(\forall(x))(\forall(y))(\forall(z)) \; [(Mxy \wedge Oyz) \Rightarrow (Pxz \wedge Bxz)]$

Literature

Aristotle, *Metaphysica*.

Charlton, W. 2000, "Aristotle on identity", in: Scaltsas, Charles, and Gill, *Unity, Identity, and Explanation in Aristotle's Metaphysics*. Oxford: Clarendon Press.

Gentzen, G. 1935, *The Collected Papers of Gerhard Gentzen* (Szabo ed.). Amsterdam: North-Holland.

Kant, I. 1781, *Kritik der reinen Vemunft*. Akademie Verlag.

Kleene, S. C. 1967, *Mathematical Logic*. N. Y. John Wiley and Sons, Inc.

Popper, R. K. 1963, *Conjectures and Refutations*. London: Routledge and Kegan Paul.

Popper, R. K. 1959, *The Logic of Scientific Discovery*. London and N.Y.: Routledge. Quine, W. V. 1934, *A System of Logistic*. Cambridge, Mass.

Russell, B. 1910, *Principia Mathematica*. (vol. I-III) Cambridge: Cambridge University Press.

Tarski, A. 1923.-1938. *Logic, Semantics, Metamathematics*. Oxford University Press.

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Konjektures und Metalogik Regeln

Der Artikel vergleicht Poppers Standpunkt (in Conjectures and Refutations,) über den ontologischen Status logischer Deduktionsregeln mit seinem Standpunkt (in The Logic of Scientific Discovery), wonach Falsifikation als ein Teil der wissenschaftlichen Methodologie im Einklang mit der logischen Kegel des modus tollens steht. Es wurde hingewiesen auf die Überzeugungskraft der Popperschen Kritik an Ryles Standtpunkten über logische Regeln als prozedurale Regeln, die wir nur allmählich erkennen können. Poppers Standtpunkte warden im Hinblick auf die folgende Frage unter die Lupe genommen: Ist es möglich, eine logische Regel als eine Form der formalen logischen Implikation zu verstehen und zusätzliche Maßstabe für die Wahrhaftigkeitsmerkmale logischer Deduktionsregeln aufzustellen ?

<u>Mirko Jakić</u>

<u>Les conjectures et les regles méthodologiques</u>

On compare dans cet article la position de Popper (dans Conjectures and Refutations) sur le statut ontologique des regles logiques d'inférence avec sa position (dans The Logic of Scientific Discovery) selon laquelle la falsification en tant que partie de la méthodologie scientifique est en accord avec la regle logique du modus tollens. II y est montré que la critique que Popper adresse a Ryle pour considérer les regles logiques comme des regies procédurales que nous ne pouvons que découvrir est tout a fait convaincante. Les positions de Popper sont critiquées par rapport a la question que voici: Est-il possible de comprendre une regie logique comme une forme d'implication logique formette el de déterminer des criteres additionnels des conditions de vérité de la regle logique d'inférence?