On Stanisław SCHAYER's Research on Nyāya

Klaus Glashoff, Hamburg

23rd January 2004

Abstract

Stanisław SCHAYER, founder of the Warsaw Indological school in the 1930's, published some papers on Indian logic which were heavily influenced by Jan ŁUKASIEWICZ, a prominent member of the school of "Polish logic". In his work, SCHAYER tried to establish that ARISTOTLE's logic was not the correct instrument for research into the formal structure of Indian logic. In addition, he presented an interpretation of the "five-membered-syllogism" of the Nyāya in terms of modern predicate logic. We will discuss both of his accomplishments in detail, showing how his research depended on the state of European logic around 1900 which had just undergone a radical transformation. It was the time of complete abandonment of Aristotelian logic in favour of modern predicate logic. Stanisław SCHAYER's method of research reflects his tight relation to Jan ŁUKASIEWICZ, who, together with Bertrand RUSSELL, was one of the leading figures trying to push modern mathematical logic into the area of philosophy. A detailed understanding of this process will help us to revaluate the interesting as well as the problematic aspects of Stanisław SCHAYER's view of Indian logic. It may also give rise to reflections on the role of formal methods in the study of Indian logic in general and thus, hopefully, may help to prevent us from repeating the mistakes committed by early modern interpreters of ancient Greek and Indian logic.

Contents

1 Introduction

During the years 1932/33, the Polish indologist Stanisław SCHAYER[1] published two papers[2] on the formal interpretation of ancient Indian logic (Nyāya), based on the modern calculus of predicate logic. Whilst, up to then, the sole formal framework for research on Indian logic had been the traditional Aristotelian syllogistic, SCHAYER was the first scholar to apply modern concepts of mathematical logic to the "Indian syllogism"[3].

Stanisław SCHAYER, who had studied both Indian philology and Western philosophy in Germany, seems to have come into contact with formal logic only after his habilitation in Łwow in 1924, when he met Jan ŁUKASIEWICZ[4], one of the most prominent representatives of 'Polish logic'. ŁUKASIEWICZ was the first "modern" logician who used the newly invented methods of symbolic, mathematical logic in order to interpret ancient Greek logical texts[5].

Though SCHAYER's main fields of interest were at a relatively large distance from logic, his aforementioned papers indicate a remarkable knowledge of modern concepts of formal logic. He was deeply convinced of the necessity of shaping the study of Indian logic by means of the mathematical symbolism of predicate logic. This formalistic attitude, rendering the access to his texts almost impossible for most of his fellow indologists, may have led to how KUNST described the impact of SCHAYER's logical research:

> The repercussion of his theories cannot be claimed to be vigorous or enthusiastic, nor can the opposite be stated. ([Kun57], p.23).

Nevertheless, SCHAYER's logical work did have some influence on modern interpretation of Indian logic[6], and, in connection with a recent revival of the scientific and historical appreciation of Stanisław SCHAYER's work in Poland, there may be some interest in an reassessment of SCHAYER's logical methods and results, which we will give in this paper.

In our reappraisal, we will step into the details of SCHAYER's logical work, trying to understand the motives for his harsh and, in hindsight, unjust statements on certain aspects of the history of European logic. We will realise that Stanisław SCHAYER's pointed and scathing criticism of the traditional way of interpretation of the Indian syllogism as well as his enthusiastical proposal for a better formulation of the Nyāya-scheme can only be comprehended by taking into account the historical situation in European formal logic during the beginning of the twentieth century.

We start this paper by elucidating the importance which Jan LUKASIEWICZ' work had for SCHAYER's research on Indian logic.

2 In the footsteps of Jan ŁUKASIEWICZ

SCHAYER's starting-point is his firm conviction that Indian logic can only be understood by the employment of modern symbolic logic. His diagnosis of the state of research in the area of Indian logic at the beginning of the 1930s is as follows.

> We do not have a satisfactory account of Indian syllogistics, and what can be found about them in the literature is partly unclear and vague and partly false and misleading. There is no doubt about the causes of this predicament. They have to do with the fact that those indologists who have written about formal-logical aspects of Nyāya so far are not familiar with European logic. ([Sch33], p. 102)

[1] Bibliographical data on Stanisław SCHAYER (1899 – 1941) may be found in [Kun57] (revised edition with an exhaustive biographical list compiled by M. MEJOR in [BM99]). C.f. also [Mej03a].

[2] The original German texts of [Sch32] and [Sch33]were reprinted in [Sch88]. We will quote only the English translation by Joerg Tuske, in [Gan01]. C.f. also the English translation of [Sch33] in [BM01].

[3] SCHAYER continued to use this term in spite of his efforts to show that the five–membered Nyāya–scheme should not be considered as an instance of an Aristotelian syllogism. We will also make use of this term, which seems to have become a standard notation within the field of Indian logic.

[4] ŁUKASIEWICZ (1878 - 1956) was a student of Kazmierz TWARDOWSKI, who founded the "Lwov – Warsaw – School" in 1895. (cf. [Adj35], [Wol89]).

[5] ŁUKASIEWICZ' main work on this topic is his book [Lu57] in which he published the results of his research from more than three decades.

[6] Cf. [Oet94, Gan01].

> ... it is time to approach the Nyāya texts with logical, not just with philological or philosophical competence. ([Sch33], p.103)

Like ŁUKASIEWICZ, Stanisław SCHAYER had studied Western philosophy scrupulously, and just as ŁUKASIEWICZ, was convinced of the value of modern formal methods for the interpretation of ancient Greek logic, SCHAYER seems to have maintained a similar view concerning the general value of Western philosophical concepts for the study of Indian philosophy: Western philosophy

> ....was to help him in the formulation of Indian philosophical principles which, he believed, were to a high degree translatable into Western conceptions without losing their intrinsic originality. ([Kun57], p. 18).

Thus it is understandable that ŁUKASIEWICZ' successful research on Aristotelian logic, employing modern formal methods, exercised great attraction on Stanisław SCHAYER. ŁUKASIEWICZ taught at Warsaw University from 1915 to 1939, and Stanisław SCHAYER started his teaching at Warsaw University in 1926. We do not know exactly when and how both men met.[7] Most probably SCHAYER attended ŁUKASIEWICZ' introductory lectures delivered at Warsaw University in the autumn trimester of the academic year 1928/29[8]. In 1928, ŁUKASIEWICZ was fifty years of age and at the highest point of his scientific and university career whilst Stanisław SCHAYER was a young, recently habilitated docent of barely thirty years of age.

Due to the influence of ŁUKASIEWICZ' work, SCHAYER became involved in the revolution of European logic which started about the middle of the nineteenth century and which – within some fifty years – led to a complete abolishment of the Aristotelian tradition from the Western universities and to its replacement by modern predicate logic. Together with RUSSELL, ŁUKASIEWICZ was one of the most committed fighters against any form of earlier "philosophical logic" which these men considered to be quite worthless[9]. As a fellow junior combatant in a fight in which both sides were engaged with much determination and emotions, SCHAYER's role was to introduce the new reign of formal logic into the land of indology:

[7] St. SCHAYER was "much influenced" and "inspired" by J. ŁUKASIEWICZ. This is a quotation from [Mej03a]. I asked Prof. MEJOR (Warsaw) whether something is known about contacts between ŁUKASIEWICZ and SCHAYER. He wrote to me ([Mej03b]): "For that purpose I made a research in Archives of the Warsaw University and the Polish Academy of Sciences (Warsaw). The result of my investigation is negative – in the sense that I could not find any trace of such a contact in the available documents, both in the archives and in the published/printed ones. I checked also the unpublished Memoirs of Łukasiewicz from 1945/50 with negative result too. Please kindly remember that what has survived the Second War is but a small fraction of the original collections. In September 1939 Warsaw was heavily bombed and in August-October 1944 Warsaw was virtually turned into ruins and ashes. At the very beginning of the war Gestapo confiscated all the personal documents of the Warsaw Scientific Society – both Lukasiewicz and Schayer were full members of the Society. (During the whole period of Nazi occupation Polish intelligentsia was persecuted in particular; for example, a large group of professors of the Jagiellonian University was murdered). You can find mention of these tragic events in the brief autobiography compiled by Łukasiewicz in 1953 (published in: Jan Łukasiewicz, *Logika i metafizyka*. Micellanea pod redakcja Jacka Juliusza Jadackiego. Warsawa 1998, p. 2-4) and in the diaries of many other eminent Polish scholars we find the same sad story – all their property, including books, papers, correspondence, archives, etc. turned into ashes (it is not necessary to add that Schayer's property was destroyed too). Therefore no wonder that in the remaining scanty documents there is no mention of their contacts. But certainly they must have known each other – Łukasiewicz was one of the most eminent professors of the Warsaw University, moreover he was twice elected Rector."

[8] Prof. Mejor wrote to me ([Mej03b]): "Whether Schayer attended Łukasiewicz's lectures and/or seminars cannot be established. Certainly Schayer knew his publications (in particular Schayer mentioned his Elements of Mathematical Logic, a series of lectures delivered at Warsaw University, edited by his student M. Pressburger and published in 1929) as well as the publications of the so-called Lvov-Warsaw philosophical school – Kotarbiński, Adjukiewicz (cf. also [Mej03a]). In 1926-29 Schayer was 'Privatdozent' at the Warsaw University. From January 1929 Schayer was nominated assistant professor at the chair of philosophy (opinions were written by Prof. W. Tatarkiewicz [1886-1980] and Prof. T. Kotarbiński [1886-1981]). From 1 October 1929 Schayer was nominated assistant professor at the chair of Indian philology, and from December 1930 'extraordinary' professor ('außerordentlicher Prof.') (cf. [Sch88]: xiiiff). In that period, Łukasiewicz was giving lectures at the Warsaw University. Considering Schayer's active interest in philosophy one can surmise that they met, at least Schayer could have attended Łukasiewicz's (public) lecture(s). But alas! so far no document has been found confirming such a fact." The notes from these lectures are entitled *Elements of Mathematical Logic* (First Polish edition: *Elementy logiki matematycznej*, Komisja Wydawnicza Kola Matematyczno-Fizycznego Słuchaczów Uniwersytetu Warszawskiego, Vol. 18, Warszawa 1929. English translation of the second edition: [Lu63]). They cover the two simplest logical systems, namely the sentential calculus and Aristotle's syllogistic.

[9] ŁUKASIEWICZ was very straightforward in his rigorous judgements on many philosophers of the past. Here is one of his typical comments: "When we approach the great philosophical systems of Plato or Aristotle, Descartes or Spinoza, Kant or Hegel, with the criteria of precision set up with mathematical logic, these systems fall to pieces as if they were houses of cards. Their basic concepts are not clear, their most important theses are incomprehensible, their reasoning and proofs are inexact, and the logical theories which often underly them are practically all erroneous [Bor70], p.111."

> .... obviously following ŁUKASIEWICZ' successful application of formal logic to the study of the ancient Greek logicians, he (SCHAYER, K.G.) did the same with regard to ancient Indian logic. ([Mej03a], p. 10).

SCHAYER pursues a twofold aim with his papers on Indian logic: He tries to convince his readers that Aristotelian logic is not the correct instrument for research on Nyāya and that there is a modern formulation of the five-membered Nyāya–"syllogism" in terms of predicate calculus:

> We can only do justice to the meaning and possible developments of the Indian syllogistic by seeing it as a prescientific anticipation of some forms of inference which we know from modern logic (e.g. RUSSELL's 'theory of apparent variables' or HILBERT's 'narrower functional calculus'). Indology has to rid itself from the false suggestion that the Aristotelian or the traditional syllogistic provide a suitable basis for the interpretation of the problems of Nyāya philosophy. ([Sch32], p. 96).

He defines precisely the 'positive value' of the knowledge of modern logic for research into Nyāya ([Sch33], p.105):

> This is
>
> (i) that we liberate ourselves from the false suggestions of traditional philosophical logic
>
> (ii) that we gain an objective, strictly scientific measure for a critical appreciation of the Indian achievements.

Apparently, he is not only going to present a new, alternative interpretation of the Indian syllogism in terms of modern formal logic, but he zealously combats the views of other indologists[10] who adhere to the traditional utilization of Aristotelian logic, caused by "false suggestions" of traditional philosophical logic. His absolutist attitude ("objective, strictly scientific measure") affects large parts of his papers on logic, and he arouses a flavour of bitter dispute between "philosophical" logicians and their adherents on the one side and the pioneers of symbolic logic on the other. Again and again he stresses the difference between (authentic) Aristotelian and traditional syllogistic:

> Indeed, what KANT and his successors understood to be Aristotelian logic is simply a misrepresented pseudo-Aristotle. ([Sch33], p. 105)[11]

This corresponds indubitably to ŁUKASIEWICZ low respect for the logic of KANT and his successors, the "philosophical logicians". In contrast to these misinterpretations, as SCHAYER calls it, for him there is one correct modern formalization of the authentic Aristotelian logic:

> However, one ought to use the authentic Aristotle, as first shown and taught by J. ŁUKASIEWICZ, not the traditional interpretation that rests on misunderstandings. ([Sch32], p. 94).

Therefore, for the purpose of a formal interpretation of Indian logic, SCHAYER recognises three different sets of "instruments":

- Traditional Aristotelian syllogistic of the 'philosophical' logicians: This had been the traditional tool in Indology, used by VIDYĀBHŪṢAṆA, STCHERBATSKY and others.
- The 'authentic','real' Aristotelian theory as formalized by ŁUKASIEWICZ.
- Modern predicate logic, directly applied to Indian logic without utilising the 'indirect' route via Aristotelian logic.

In the following sections of this paper we will discuss Stanisław SCHAYER's views on these different tools. We begin with his opinion on the "authentic" Aristotelian logic which takes up a central role within his papers.

[10] In particular, he mentions STCHERBATSKY.

[11] Maybe that SCHAYER'S pronounced negative appreciation of "KANT and his successors" is explainable by his open quarrel with STCHERBATSKY on behalf of his Kantian approach to Buddhism ([Kun57], p. 22). This disagreement on philosophical matters has nothing to do with logic but may have had also an impact on SCHAYER'S negative judgement on STCHERBATSKY'S knowledge of European logic ([Sch33], p.102). It is exactly in connection with STCHERBATSKY that the "successors" of KANT, the "philosophical" logicians ERDMANN, LOTZE, COHEN, SIGWART and later PRANTL are mentioned.

3 The 'authentic' ARISTOTLE

We will begin with SCHAYER's *general* view on Aristotelian logic, which is identical to ŁUKASIEWICZ' opinion at that time[12]:

> Aristotelian logic is not a universal and complete theory but – without questioning its historical value – a meagre fragment ([Sch33], p. 105).

Some 20 years later, however, ŁUKASIEWICZ utters a far more sophisticated estimation of ARISTOTLE's work on logic. He writes:

> It has been my intention to build up the original system of the Aristotelian syllogistic on the lines laid down by the author himself, and in accordance with the requirements of modern formal logic. .....The syllogistic of Aristotle is a system the exactness of which surpasses even the exactness of a mathematical theory, and this is its everlasting merit ([Lu57], p.131).

Nonetheless, ŁUKASIEWICZ realised that Aristotelian logic, in a certain way, was not as "universal" as modern predicate logic, and he continued the above statement as follows:

> But it is a narrow system and cannot be applied to all kinds of reasoning, for instance to mathematical reasoning.

Here he points to an important fact: In contrast to Aristotelian logic, modern symbolic mathematical logic was born not within the context of philosophy but within that of mathematics. FREGE and RUSSELL, the most prominent founders of modern symbolic logic, had developed a mighty new instrument for the "foundation" of mathematics, and they succeeded in that their modern formalism totally replaced the old one. But from that time on formal logic and philosophy went different paths, and today the rôle of logic with regard to philosophy is totally different from what it has been once in Europe after ARISTOTLE[13].

One of the main battlefields between modern mathematical and traditional logicians was Aristotelian logic. It was the only formal system which the "philosophical" side, in its adherence to classical logic and tradition, accepted. In contrast, modern "mathematical" logicians since George BOOLE had been eagerly demonstrating that the Aristotelian syllogistic could be looked upon as a simple special case of the new logic.

This dispute over the correct interpretation of Aristotelian logic had two different aspects, a syntactic and a semantic one, both of which entered into SCHAYER's verdict on the employment of Aristotelian logic. We shall now treat SCHAYER's approach to the *syntactic* system of Aristotelian logic where he completely conforms to ŁUKASIEWICZ' axiomatic approach. SCHAYER'S view on the *semantics* of Aristotelian logic, where, surprisingly, he is in clear contrast to ŁUKASIEWICZ' position (and to present-day knowledge, too), will be discussed in Appendix 1.

SCHAYER adhered to the programme of ŁUKASIEWICZ, who was the first logician to present a precise modern formalisation of the Aristotelian syllogistic which did not simply reduce the ancient logic to a trivial or even faulty special case of modern predicate logic. ŁUKASIEWICZ, by means of his axiomatic system, had been able to reproduce the entire syllogistic theory without having to impute additional assumptions and without having to "correct faults" of Aristotle's logic[14]. SCHAYER gave two reasons why, in his opinion, the traditional view on Aristotelian logic is wrong:

[12] "meager fragment " (in the German original: "dürftiges Fragment") - this is *exactly* the expression which ŁUKASIEWICZ ([Lu35] p. 120/21) uses in characterizing "that part of name logic which is embodied in Aristotelian syllogistic".

[13] While an understanding of formal logic is a crucial precondition for some parts of modern philosophy, f.i. for the theory of science, most parts of today's philosophy have no connection to formal logic at all. Formal logic, in its theoretical aspects, has become a part of pure mathematics, and, in its 'applied' aspects, a part of computer science and informatics.

[14] We refer to the problem of "existential import": In Aristotelian theory, Axy (All x are y) implies Ixy (Some x are y). Using the "standard" predicate logic formalisation of Aristotelian logic (where, f.i., Axy is defined by means of the expression $\forall\xi(\xi \in x \rightarrow \xi \in y)$, and Ixy by $\exists\xi(\xi \in x \wedge \xi \in y)$, one cannot prove Axy $\rightarrow$ Ixy without further assumptions. ŁUKASIEWICZ' deductive system does not have this defect!

> It remained unknown to the best scholars of the history of logic, including PRANTL, that
>
> (i) the real syllogism consists of a conditional and not of two premises which are linked with the conclusion through 'therefore', that
>
> (ii) in the real syllogism a universal name and not an individual name 'Socrates' has to be substituted for the subject...([Sch33], p. 105).

Both assertions refer directly to ŁUKASIEWICZ' syntactic model and belong to the very core of his modern reconstruction of Aristotelian logic. Nevertheless, especially the first of these theses[15] came under pressure by more recent research into the works of ARISTOTLE[16]. This is a complex topic, the main particulars of which we have described in our Appendix 2. Let us sum up here that today most specialists of Aristotelian logic contest both of SCHAYER's assertions quoted above. Since the 1970's, alternative formalisations of Aristotelian logic have been published which employ a calculus of natural deduction, leading to formal systems which, in many respects, mirror the ideas layed down in the *Analytica Priora* much better .

Thus, in the light of recent research, SCHAYER's statement (i), concerning the "real syllogism" is not true: Within the context of natural deduction, a syllogism is - in direct contrast to ŁUKASIEWICZ' and SCHAYER's above mentioned position - regarded as a set "of two premises which are linked with the conclusion through 'therefore"' – a view which SCHAYER ascribes to his favourite adversaries, the "philosophical" logicians.

Of course, SCHAYER cannot be blamed for the fact that, forty years after the appearance of his papers, the main paradigm of the formal interpretation of Aristotelian logic changed again completely. Nevertheless, this whole story of different modern views of Aristotelian logic is of importance, as it points to the well-known fact that interpretation is by no means and never simply an application of neutral and time-independent theoretical instruments. This applies also to the mighty instrument of modern mathematical logic, and the bitter experience of the struggle of modern logicians in correctly formalising ancient Greek logic should be kept in mind in our various attempts to put Indian logic into a certain shape with the help of formulas.

In addition there is still another grave problem with SCHAYER's main argument, which is apparent without reference to today's wisdom. In a "basic list of antitheses" ([Sch33], p. 107) he confronts two different types of formalisation: "The Aristotelian syllogism", by which he means the "authentic" interpretation as given by ŁUKASIEWICZ, and "The Indian syllogism" which is SCHAYER's own interpretation via modern predicate logic (we shall present the details in the next section of this paper). SCHAYER then shows convincingly that both these systems differ considerably and thus cannot be equated to each other. So far, his argumentation is correct. The further conclusion he draws, however, cannot be justified by his arguments:

> If ATHALYE, VIDYĀBHŪṢAṆA, and STCHERBATSKY thought that the Indian syllogism can be traced back to the Barbara mode (of Aristotelian logic, K.G.) then this is a misunderstanding which ought to disappear from indological literature ([Sch33], p. 108).

This harsh statement is unsubstantiated even within Schayer's own framework of arguments, because the above mentioned indologists belong to the group of those authors which SCHAYER elaborately charges of *not* employing the authentic, real Aristotelian logic, but, instead, of using the traditional, "philosophical" logic. Thus it makes no sense to blame them for the fact that the supposed "authentic" Aristotle (ŁUKASIEWICZ!) cannot sufficiently precisely represent the "real" Indian syllogism (SCHAYER!).

[15] We refrain from going into a detailed discussion on the assertion (ii) which is by no means as important as (i). In contradistinction to SCHAYER'S assertion, however, individual terms are common in Aristotle's *Rhetorica* as well as in his *Analytica Priora*:

Cf. the example in *An. Pr. 70 a 24–27*, where the subject is an individual named Pittakos: *"Pittakos eleutherios. oi gar philotimoi eleutherioi, Pittakos de philotimos."*(

There is also a discussion of the correct handling of singular subjects in *An. Pr. 43a* and in *de Int. 20a 23ff*. ŁUKASIEWICZ' system, however, cannot handle individual subjects.

[16] ŁUKASIEWICZ' system, finally published in his book *Aristotle' Syllogistic* in 1951, remained unrivaled until 1973 when CORCORAN and, independently, SMILEY published their papers on a calculus of natural deduction for Aristotelian logic ([Cor73]).

Let us sum up: Stanisław SCHAYER adopted ŁUKASIEWICZ' axiomatic system which he approved as the "authentic" Aristotelian syllogistic. This system was, at that time, the best possible choice - it was indeed the first rigorous modern system which did not impute hidden assumptions to ARISTOTLE's syllogistic. The problematic point of SCHAYER's choice of this system is his using it as an absolutely reliable yardstick, thus categorically dismissing the whole European tradition of two thousand years. In contrast to that, recent research has revealed that the basic assumptions underlying ŁUKASIEWICZ' system are difficult to bring into acceptable agreement with the ancient texts, and that certain formalisations of traditional logic ("KANT and his successors...") are much better suited as models for the "authentic" Aristotle. As SCHAYER, in his whole reasoning, relied on ŁUKASIEWICZ' system, the very basis of a central part of his argumentation has been destroyed.

4 SCHAYER on Nyāya

4.1 The Nyāya-scheme

SCHAYER did not only criticize the traditional Aristotelian way of looking at the Indian syllogism, he also gave a new interpretation of "Indian Syllogistic" by means of the proof theory of modern predicate logic. We will now take a closer look at SCHAYER's modern way of understanding Nyāya through the lens of predicate logic. Let us reproduce his main table ([Sch33], p. 106):

1) *pratijñā*	$\psi(a)$	There is fire on *a* (= on this mountain)
2) *hetu*	$\varphi(a)$	There is smoke on *a* (= on this mountain).
3) Statement of *vyāpti*	(x).φ(x)$\supset\psi$(x)	For every locus x: if there is smoke in x then there is fire in x
4) *upanaya* = statement of the *pakṣadharmatā*	$\varphi(a) \supset \psi(a)$	This rule also applies to *x*= *a* (for the pakṣa)
5) *nigamana* = statement of *sādhya*	$\psi(a)$	Because the rule applies to x = a and the statement φ(a) is true, the statement ψ(a) is true

This table calls for an interpretation as a four-step predicate-logical proof of the *pratijñā* within the modern framework of "natural deduction" [Gan01, Oet94]. The problem with such an interpretation is that the concept of "natural deduction" was not yet known when SCHAYER's papers on logic appeared in 1932/33. However, probably due to his contacts with the Polish school of logic, he had been correctly informed of the main ingredients of such a theory. We refer to Appendix 3 for details on the corresponding formal logical aspects.

The main problem with SCHAYER's text is its lack of precise reference of the five steps of his scheme to ancient texts. He writes about "the Indian authors" and promises "to clarify what the Indian syllogism really is, i.e. how to understand it from the standpoint of modern logic" but he does not specify which ancient text or texts he exactly refers to or which period of Indian logic he adresses. In his main paper on this subject, [Sch33], he mentions Nyāya-sūtra and -bhāṣya as well as Nyāya-mukha and Tarka-saṃgraha, which cover an immense space of time. Within this period, the "Indian syllogism" underwent substantial changes which render futile any attempt to find a formalisation in a single scheme.

Let us, for example, look at step 3 of SCHAYER's table. In ancient Nyāya, this step was called *udāharaṇa*, and it was very different from *vyāpti*, a term which has its origin in the works of the mediaeval Buddhist logician DIGNĀGA[17]. Much has been said about the rather slow development of *udāharaṇa* into the statement of *vyāpti*, and this is not the place to discuss this topic at length. Regarding SCHAYER's paper, so much must nevertheless be said: it is not correct to omit any comment whatsoever on the rôle of examples in the third step of the scheme, presenting "the" Indian syllogism without mentioning *udāharaṇa* or *dṛṣṭānta* at all. He simply keeps quiet about the fact that the "example" continues to play an important role even in post-Buddhist times when Naiyāyikas switched to one type of theory of *vyāpti* or another. Of course, the introduction of *any* kind of example or exemplification would have destroyed the miraculous correspondence between the "Nyāya

[17] I thank S. KATSURA for pointing this out to me.

scheme" and the proof theory of predicate logic which SCHAYER was so convinced of[18].

Let us finally look at the fourth step, the *upanaya*, which SCHAYER calls the "statement of the *pakṣadharmatā*". This characterization is a bit odd, as the notion of *pakṣadharmatā*, as it is usually understood, refers exactly to what is stated in step 2 ("*hetu*"), i.e., $\varphi(a)$. While this might be tolerated for the classical (Aristotelian) interpretation which tends to identify steps 2 and 4, it is certainly wrong for SCHAYER's own interpretation which, exactly at this point, differs strongly from the classical one. Concerning *upanaya*, he writes:

> The proposition $\varphi a \supset \psi a$ which is gained by this operation is not explicitly stated in the Indian syllogism because Indian logic does not emphasise the completeness of a proof. However, the words *tathā cāyam* ['This is thus'] hint at this step clearly enough.

I do not consider this point as being as clear as SCHAYER suggests. He does not present any further argument nor textual justification for his rather unconventional interpretation. Some sixty years later, it was OETKE who performed an acribic study on exactly this and related matters. In the first of his four studies regarding the ancient Indian syllogism, he presents a certain modification of SCHAYER's scheme. OETKE finds some textual basis for *his* interpretation[19] of *upanaya* which is similar but by no means identical to SCHAYER's: there are indeed passages in a Chinese text, retranslated by TUCCI[20], as well as in the *Nyāyabhāṣya* of Pakṣilasvāmin and in the *Praśastapādabhāṣya* supporting the view that, within the corresponding five-membered schemes, *upanaya* not only contains a reference to *hetu* but also to *sādhya* as well as to their concomitance in the *pakṣa* . While all this may imply that the identity of step 2 and step 4, as it is implied by the Aristotelian interpretation, is not necessarily true, this does *not* support SCHAYER's version of *upanaya*. Therefore, our final result is that, in full awareness of OETKE's research, there is no reason to accept SCHAYER's remark, that "clearly enough" *upanaya* has to be interpreted just the way he did.

4.2 Anticipation of modern logic

The result of the preceding section is that SCHAYER's attempt to give a "scientific", sound interpretation of the "Indian syllogism" did not succeed. His attempt to identify the five-membered Nyāya-scheme as an anticipation of a proof-scheme of modern predicate logic not only sounds bizarre but apparently has no textual basis. We shall now try to clarify the reasons for his failure. For this purpose, let us look at how strongly he emphasises the value of knowledge of modern logic for research into Nyāya:

> In order to critically appreciate the achievements of Indian authors as anticipations of scientific logic, the indologist needs 'a reliable point of reference' with regard to which the history of Indian theories can be seen and from which this history can be viewed. The fact that this 'reliable point of reference' can only be found in modern symbolic or mathematical logic is impossible to doubt these days[21].

SCHAYER is quite sure that by means of modern predicate logic

> .... we gain an objective, strictly scientific measure for a critical appreciation of the Indian achievements[22].

Today, his admiration of the objectivity of modern logic presumably amazes many of us, as we know betternow than in the 1930s of the last century that predicate logic and its philosophical sister, analytic philosophy, are not at all "objective scientific measure(s)" free of all presuppositions and

[18] Predicate logic is, of course, flexible enough to allow for expressing the example within the Nyāya scheme in terms of predicate-logical formulas. This is what OETKE did in his paper [Oet94]. Let us remark that OETKE's formalisation, resolving one problem, at the same time raises others which we cannot, at this place, deal with adequately.

[19] OETKE looks at the five-membered Indian syllogism as a proof scheme of natural deduction type. Therefore his attempt to correct and amend SCHAYER's scheme in [Oet94], Chapter I, is subject to the same problematic of imputing a "Western" formalism into an ancient doctrine, in this respect not differing significantly from SCHAYER's method.

[20] [Tuc29]

[21] [Sch33], p. 106

[22] [Sch33], p. 105

ontological commitments. SCHAYER, a true disciple of ŁUKASIEWICZ also in this respect, did not have such a reserve with respect to modern logic - on the contrary, his aim was to prove an inherent connection between ancient and modern logic:

> It becomes clear that Indian texts anticipate a number of theses which do not have any connection with Aristotle, but which anticipate Stoic dialectic and propositional calculus. Critical appreciation of this intuitive anticipation is an important preliminary work for a general history of logic[23].
>
> I am going to close with some remarks on the notion of 'anticipation'. 'To anticipate' means 'to take before' or to 'pre-form' and one has to stick to this meaning. The Indian syllogistic is a 'preformation' of some forms of inference which we know from modern logic.[24]

SCHAYER adopted the concept of "anticipation" from ŁUKASIEWICZ, who held an analogous view on Aristotelian logic. PATZIG, a renowned expert of modern interpretation of Aristotelian logic who carried on ŁUKASIEWICZ' work, at the same time building on the foundations which ŁUKASIEWICZ' laid as well as precisely pointing to the defects of his view, wrote in the preface of his book on Aristotelian logic[25]:

> The energy Łukasiewicz invests in relating the text of Aristotle to modern mathematical logic, and the exclusiveness of his formulating Aristotelian logic as pre-stage or "germ form" (Keimform) of modern logic, has stimulated and tightened the scientific discussion about the nature of Aristotelian logic. Both facts, however, observed from another viewpoint, constitute the proper deficiency of his book which, in many a respect, is so excellent and astute. If one considers a traditional text mainly as steppingstone to something else, i.e. as anticipation of later knowledge, one can neither do justice to the text nor to its author.

Stanisław SCHAYER's clearly outspoken subordination of Indian logic to the objective power of modern Western logic is very different from a "postmodern" standpoint which would allow one to try out different formalizations of Indian logic in order to throw light onto it from different directions. And SCHAYER's view certainly does not conform to an admonition W. HALBFASS stated in 1992:

> Conceptual devices that have been developed by Western philosophical thought will be indispensable tools of translation, interpretation, and analysis; but we will have to use them cautiously. We have to be aware that our own ontological concepts and premises are problematic[26].

5 Conclusion

In our paper, we first have attempted to elucidate the scientific relation between the indologist Stanisław SCHAYER and the logician Jan ŁUKASIEWICZ. It seems that SCHAYER was a close disciple of ŁUKASIEWICZ in many respects:

- He adopted ŁUKASIEWICZ' concept and formalisation of the 'authentic' Aristotelean logic.
- He agreed with ŁUKASIEWICZ in the estimation of Stoic propositional logic.
- He shared ŁUKASIEWICZ' devaluating criticism of the "philosophical logicians" since KANT.
- He regarded ancient Indian logic as "anticipation" of modern predicate logic in the same way ŁUKASIEWICZ considered Greek logic to be.

[23] [Sch33], p.105
[24] [Sch33], p. 108.
[25] [PAT63](my translation).
[26] [Hal92], p. 15

- Both men were convinced that only "modern, scientific logic" was the "objective" instrument for research into the history of logic.
- SCHAYER'S stinging and pointed diction resembles ŁUKASIEWICZ' notoriously polemical way of writing very closely[27].

As most of Stanisław SCHAYER's arguments on the subject of Western logic are completely based on ŁUKASIEWICZ, the fate of SCHAYER's respective assertions is closely tied to the evolution of ŁUKASIEWICZ' ideas which rose to the zenith of its global scientific acceptance during the 1950s and 1960s. Today's wisdom shows us that almost none of SCHAYER's statements on "authentic" Aristotelian logic has passed the test of time.

Most scholars of Aristotelian logic agree today that ŁUKASIEWICZ' work on Aristotelian logic, while having been the first valuable modern contribution to this subject, is outdated. More recent formalizations of Aristotelian logic appear to be much nearer to what "philosophical logicians" from LEIBNIZ and KANT onwards tried to establish. Thus, the gap between the "authentic" and the "traditional" Aristotelian syllogism detected by ŁUKASIEWICZ and vehemently insisted on by SCHAYER is by far not as wide as these men imagined. Today there are interpretations of Aristotelian formal logic in terms of a modern correct and sound formalism which catches all the important aspects of the Aristotelian syllogistic and stands in the continuity of the traditional approach. Thus Stanisław SCHAYER's damning review of the traditional philosophical logic and its application in the Indian syllogistic was not only immanently unconvincing but has even to be rejected because of more recent research on Aristotelian logic.

Concerning the second of his aims, namely, to present a new interpretation of the Nyāya–"syllogism" in the framework of modern logic, this has certainly to be considered as an act of "modernization" for which SCHAYER deserves merit even today. In the present paper, however, we have adduced reasons for the assertion that SCHAYER's interpretation is not convincing and that it raises more question than it settles. One main point of our criticism is the ahistoric approach of his remarks on Nyāya: at no place does he state clearly which stage of the developement of Indian logicNyāya the five items of his scheme refer to at exactly. Thus it is almost impossible to find out which sources lead him to his far-reaching assertions on the similarity of ancient Nyāya texts with concepts of modern symbolic logic.

The other point is SCHAYER's firm belief that the history of logic should and can be

> measured more objectively and be represented as the history of discoveries and positive progress. ... The fact that this 'reliable point of reference' can only be found in modern symbolic or mathematical logic is impossible to doubt these days ([Sch33], p.106).

Thus he assigns a role to modern symbolic logic which is not adequate, as in fact modern mathematical logic is only one very special "variety" [Boc56] of formal logic which, as we know today, covers only a limited area of the vast field of formal reasoning. This mistaken view led SCHAYER to consider parts of Indian logic as

> .... 'preformation' of some forms of inference which we know from modern logic ([Sch33], p.108).

This led him to formulate "the" Indian five-membered syllogism as a proof scheme of predicate logic. This interpretation is neither convincing nor well founded in ancient texts, accordingly, does not seem to have found much acceptance among indologists[28].

Although all this may sound very critical, one has to take into account some biographical and historical facts in order to do justice to SCHAYER's ogical works. SCHAYER's view of Nyāya can only be understood if one takes into account the influence which the very strong and productive Polish School of Logic exerted on him. When SCHAYER, presumably on the occasion of ŁUKASIEWICZ' introductory lecture on logic in 1929, came in contact with Jan ŁUKASIEWICZ, he was a young

[27] In the foreword of the "Selected Works" of Jan ŁUKASIEWICZ [Bor70], his pupil SŁUPECKI writes: "This paper provides a very fine example of Łukasiewicz's polemic talent."

[28] Even though BOCHENSKI, in his book [Boc56], p. 121, refers positively to the work of SCHAYER, he does not reproduce SCHAYER's interpretation of the five-membered Indian scheme.

indologist and philosopher who obviously was influenced by the euphoric mood of ŁUKASIEWICZ and his pupils, who were very actively taking part in one of the most fundamental revolutions of Western logic. In addition, ŁUKASIEWICZ' objections against KANT and the German idealism may have attracted SCHAYER who was then quarreling with the well-known indologist STCHERBATSKY on behalf of certain aspects of Buddhist philosophy[29].

Stanisław SCHAYER cannot be blamed for the fact that, today, major parts of ŁUKASIEWICZ' assertions on Aristotelian logic are no longer well accepted by the scholarly community. Neither can he be made responsible for the vanishing of the euphoria about the power and objectivity of modern logic which has taken place from the 1930s until now. Therefore, our detailled criticism of his views should not be regarded as an attempt of belittling a renowned indologist. It is, however, intended for promoting a more sophisticated view on the relation of formal logic and ancient texts than ŁUKASIEWICZ and his school held during the first half of the past century - a view, which, unfortunately, has not disappeared completely even today.

6 Appendices

6.1 Semantics of Aristotelian logic

In contrast to the situation concerning syntactical matters, SCHAYER's position with respect to the semantics of Aristotelian logic is, quite surprisingly, different from that of ŁUKASIEWICZ. SCHAYER adheres to the standard class-theoretical interpretation which had been in vogue since the early days of modern logic at the beginning of the nineteenth century. This view was the "official" position which RUSSELL propagated and which appeared in HILBERT and ACKERMANN's book, quoted by SCHAYER.

This standard interpretation of Aristotelian syllogistics is as follows. The "variables" A, B, Γ, Δ, etc. of ARISTOTLE's *Analytica Priora* are interpreted as class variables and the Aristotelian "quantifieres" A, I, etc. by means of class-inclusion and –intersection. SCHAYER refers to this "extensional" interpretation (and, by the way, obviously *not* to the words of the Greek text he quotes) when he writes

> "The formula *'to A panti tōi B hyparchei'* teaches us that there is a relation of inclusion between the classes A and B ...." ([Sch88], p. 104).

Today we know that this view is not correct: Even if ARISTOTLE may have, at some places, referred to extensional concepts, his whole formal logic fits much better into an *intensional* framework, thus realising exactly what "philosophical" logicians from LEIBNIZ to KANT and, to name the last German exponent of this school, FREYTAG-LÖRINGHOFF, had in mind.

Ironically, it was just ŁUKASIEWICZ, admired and ever-mentioned by SCHAYER, who had been very eagerly correcting this fundamental error in the interpretation of Aristotelian logic by his fellow formal logicians[30]! As this is a central point in the history of logic we are going to quote his arguments at some length:

> Aristotle's logic was not only misrepresented by logicians who came from philosophy, since they wrongly identified it with traditional syllogistic, but also by logicians who came from mathematics. In text-books of mathematical logic one can read again and again that the law of the conversion of the A-premise and some syllogistical moods derived by this law, like Darapti or Felapton, are wrong. This criticism is based on the mistaken notion that the Aristotelian universal affirmative premise "All a is b" means the same as the quantified implication "For all c, if c is a, then c is b", where c is a singular term, and that the particular affirmative premise "Some a is b" means the same as the quantified conjunction "For some c, c is a and c is b", where c is again a singular term. If one accepts such an interpretation, one can say of course that the law *CAabIba* is wrong, because a may be an empty term, so that no c is a, ... But all this

[29] For background information on this subject, cf. [Kun57].

[30] On p. 219 of his book [Lu57], ŁUKASIEWICZ even mentions RUSSELL'S false views on Aristotelian logic!

> is an imprecise misunderstanding of the Aristotelian logic. There is no passage in the Analytics that would justify such an interpretation. Aristotle does not introduce into his logic singular or empty terms or quantifiers. He applies logic only to universal terms, like 'man' or 'animal'. ... The syllogistic of Aristotle is a theory neither of classes nor of predicates; it exists apart from other deductive systems, having its own axiomatics and its own problems.([Lu57], p.)

I think that this as clear as it could ever be. What ŁUKASIEWICZ found out is widely accepted today by the experts in the field, however, has not found its way into textbooks on logic. I do not know why Stanisław SCHAYER belonged to those who did not share his teacher's standpoint. Probably ŁUKASIEWICZ changed his view on these matters between 1929 and 1951, a possibility which suggests itself by some passages in his early book [Lu63].

6.2 Axiomatics versus Natural Deduction

One of ŁUKASIEWICZ' main theses on Aristotelian logic was the assertion that (as Schayer put it)

> the real syllogism consists of a conditional and not of two premises which are linked with the conclusion through 'therefore'[31].

This points to a central difference in the interpretation of Aristotelian logic between ŁUKASIEWICZ on the one hand and traditional logic on the other. This difference is a relatively technical issue of modern logic, concerning different concepts of a formal system of predicate logic. However, as SCHAYER assigned a central role to the understanding of this difference[32], be it for Aristotelian or Indian logic[33], we will make some remarks on this point:

Any modern logical calculus has two important ingredients:

- Axioms, i.e. formulae which serve as starting points for the derivation of theorems;
- Inference rules, i.e. rules which govern the process of theorem derivation.

Regarding the "design" of any system of symbolic logic, there is some freedom of putting the weight either more on the axiomatic or more on the inference rule side. Extreme "axiomatic" systems like RUSSELL's system of predicate logic usually possess only two inference rules (Modus Ponens, Substitution), whilst, on the other extreme, calculi of "natural deduction" have many inference rules and only a few axioms.

In his work on Aristotelian logic, ŁUKASIEWICZ vehemently argues that the Aristotelian syllogistic is an axiomatic theory. His axioms[34] are the rules of propositional logic, together with two syllogisms which he writes as a "logical theorem which is formulated as a conditional"[35]. In modern notation, the fundamental Barbara-syllogism must then be written as

$$\vdash Axy \wedge Ayz \rightarrow Ayz.$$

In contrast to that, traditional logic has regarded a syllogism as a rule, allowing one to infer a conclusion from two premises (the line under the two premises denoting the "therefore"):

$$\frac{\begin{array}{c}Axy\\Ayz\end{array}}{Axz}$$

[31] [Sch33], p. 105.

[32] "The difference between a logical theorem and a logical rule of inference is of fundamental difference ([Sch32], p. 94)".

[33] In his "list of basic antitheses" he writes: "The Aristotelian syllogism is a logical theorem which is formulated as a conditional; the Indian syllogism is a combination of rules of inference ([Sch33], p.107)".

[34] [Lu57], p. 88. His choice of the *'Datisi'* syllogism, together with *'Barbara'*, as one of the axioms has no historical foundation in the papers of ARISTOTLE. It is due to a decision of LUKASIEWICZ concerning the elegance of his formal system with respect to a certain minimization of the number of axioms required. With respect to the original work of ARISTOTLE, *Celarent* would have been a better choice than *Datisi.*

[35] The conditional (proposition) reads "If Axy and Ayz, then Axz". Strictly speaking, there are infinitely many axioms of this type, as x, y, and z are of course allowed to vary.

We will not go into the technical details of the differences, similarities and connections between these alternative ways of formalising logical systems. Let us just remark that the first systems of predicate logic (RUSSELL) and also, as we have mentioned before, ŁUKASIEWICZ' Aristotelian system, belong to the axiomatic variety.

As traditional Aristotelian logic had never been a totally symbolised system like modern calculi, ŁUKASIEWICZ could not make an exact comparison of his new system with the traditional one, and the scientific community accepted his interpretation which, by the way, circumvented some grave errors committed by the first modern interpreters of Aristotelian logic. However, the situation changed. In 1934, GENTZEN and, independently, JASKOWSKI[36] published their works on systems on "natural deduction" (where the main emphasis rests on rules of inference), and in 1972/73 CORCORAN [COR73] and, independently, SMILEY[37], published their papers on formal systems of Aristotelian logic based on calculi of natural deduction. In clear opposition to ŁUKASIEWICZ, CORCORAN's and SMILEY's theories are directly linked to the traditional Aristotelian syllogistic, regarding syllogisms as rules of inference. Thus it became possible to compare the traditional syllogistics, formalised by a calculus of natural deduction, with ŁUKASIEWICZ' version, and to relate both systems to the classical texts of Aristotle. Today, almost no scientist adheres to ŁUKASIEWICZ' view, the main drawback of which is the employment of propositional logic (of Stoic origin), of which no trace can be found in Aristotelian texts.

6.3 Formalities

The following lines represent the formally correct transformation of SCHAYER's table into the language of a system of "natural deduction" ([**?**]):

A	Statement	(*pratijñā*):	$\psi(a)$		
B	Proof:				
	{1}	(1)	$\psi(a)$	*hetu*	Premise
	{2}	(2)	(x).φ(x)$\supset\psi$(x)	*vyāpti*	Premise
	{3}	(3)	$\varphi(a) \supset \psi(a)$	*upanaya*	2,3 Universal quantifier
	{1,2}	(4)	$\psi(a)$	*nigamana*	1,3 Modus ponens

As we have already mentioned in Appendix 2, the calculus of natural deduction, today being the standard way of presenting not only Aristotelian but also predicate logic, was published as late as 1934, after the publication of SCHAYER's papers on logic, by GENTZEN and, independently under a different designation, by JASKOWSKI. In any case, even if such a calculus had not been available in 1932/32, the difference between axiomatic and rule-based deductions seems to have been familiar to SCHAYER, who stresses the "fundamental significance" of "the difference between a logical theorem and a logical rule of inference" ([Sch32], p. 94). While, following ŁUKASIEWICZ, he rejected the "traditional" idea that an Aristotelian syllogism is a rule of inference, he regards the "Indian syllogism" as a succession of the application of two logical rules ([Sch33], p. 107):

- *upanaya* = rule of substitution
- *nigamana* = rule of separation (Modus ponens)

Thus it is not totally anachronistic to regard SCHAYER's table as four-step natural induction proof. However, SCHAYER did not have such a calculus at hand and, in his texts, often switches to utilizing RUSSELL's classical notation. Thus, he writes ([Sch32], p. 94):

> The difference between a logical theorem and a logical rule of inference is of fundamental significance. If one wants to ignore this difference in order to summarise the whole Indian syllogism in one thesis, one gets a statement which is known as 'Russells theory of apparent variables': $(x).\varphi(x) \supset \psi(x) : \varphi(a) : . \supset \psi(a)$[38]= 'if for all values

[36] JASKOWSKI, a student of ŁUKASIEWICZ (and also of QUINE, who, during his sojourn inEurope, worked with JASKOWSKI) presented his results as early as 1926 in ŁUKASIEWICZ' seminar ([Mar94]), thus *possibly* SCHAYER came into contact with this theory before he wrote his papers on Indian logic. In any case, even if a complete calculus of natural deduction was not available in 1932/32, the difference between axiomatic and rule-based deductions was familiar to the logic community in Poland some years before the GENTZEN/JASKOWSKI invention of the calculus of natural deduction.

[37] [Smi73]

[38] I have restored the formula to the German original which differs from the formula printed in the translation [Sch32].

of the variable x the propositional function φ implies the propositional function ψ, then the propositional function φ implies the propositional function $\psi$for the value $x = a$'.

In his paper [Sch33] he states (p. 107):

> Expressing this proof correctly in the form of a conditional we get the following theorem which is well known from Russell's 'theory of apparent variables'*:* $(x).\varphi x \supset \psi x : \varphi a : . \supset \psi a$[39]= if for all values of the variable x the function φ implies the function ψ, then the proposition φa implies ψa."

By comparing both formulas we realise that they differ only by some rather unimportant brackets, and certainly SCHAYER wanted to convey the following formula, now written in modern notation[40]:

$$\vdash (\forall x(\varphi x \rightarrow \psi x) \wedge \varphi a) \rightarrow \psi a \tag{1}$$

However, this formalisation, obviously intended by SCHAYER, has *not* been done 'correctly in a form of a conditional'! A close look at his formula reveals that it is *not* the correct formalisation of the 'if....' sentence following on it: the sentence contains three conditionals ("if.... implies... then... implies"), while the formula has only two conditionals (denoted by 'horseshoes" $\supset$ in the original notation). The correct expression of his *verbal statement* ("if for all values ...") reads

$$\vdash \forall x(\varphi x \rightarrow \psi x) \rightarrow (\varphi a \rightarrow \psi a) \tag{2}$$

but this not the "whole Indian syllogism in one thesis", but only one step (*upanaya*) of his scheme! SCHAYER writes down formula (1) but verbally explains it with reference to formula (2). From the context it is clear that he wanted to say

- $\vdash (\forall x(\varphi x \rightarrow \psi x)) \wedge \varphi a \rightarrow \psi a)$= 'if for all values of the variable x the propositional function φ implies the propositional function ψ, (which implies that the propositional function φ implies the propositional function ψ for the value $x = a$), and if, in addition, φa, then ψa holds true,

which is indeed a theorem of RUSSELL's calculus.

I admit that this is not a very grave mistake, inasmuch it has no consequences for the rest of the argumentation. However, such problems with a correct formalization of verbal statements in terms of predicate logic are ubiquitous and it is not easy to find a paper on Indian logic in which predicate logic is being employed without errors of this or similar kind[41].

7 Acknowledgements

I would like to thank Prof. S. KATSURA for his critical reading of the first version of the manuscript during his stay at Hamburg (Germany) in May/June 2003 and for many interesting discussions on the subject of the five-membered Indian "syllogism". He did not only kindly help me with the translation of various Sanskrit texts but also corrected some errors in my first draft of Section 5. Dr. Claus BRILLOWSKI, Hamburg, made valuable suggestions concerning the relation between Aristotelian and modern logic and called my attention to the early papers of ŁUKASIEWICZ. Dr. Birgit KELLNER and Dr. Eli FRANCO, both in Vienna, read the whole paper very carefully and critically. They both proposed many corrections and amendments which lead to serious revaluations

[39] The translator has corrected an obvious misprint within the German original.

[40] where the symbol '$\vdash$" denotes "That what follows is a theorem of predicate calculus". SCHAYER, like most "users" of predicate logic, does not employ this notation which, however, is a very important ingredient of RUSSELL'S calculus as it signifies that the formula following behind it is a theorem.

[41] I cannot but hope that this paper is now free of such errors - the preliminary versions were not!

of many facts and to a complete reformulation of the paper, the final form of which I am, of course, responsible for all alone. Eli also performed the painstaking task of correcting and polishing the English language of my text. Prof. Marek MEJOR, Warsaw, very kindly anwered my questions regarding the relation between ŁUKASIEWICZ and SCHAYER (cf. footnotes 7 and 8), and he also provided me with copies of papers of Polish scholars which I did not know before. Prof. MEJOR let me know that he did not agree with some parts of my paper, which led to some modifications of the text and, in addition, to the following epilogue.

8 Epilogue

When I wrote this paper I was well aware of the fact that my relatively rigorous critique of SCHAYER's work on the five-membered syllogism would provoke some opposition by those who possibly know his whole work better than I do. During the process of writing and rewriting parts of the first version I came to a much more differentiated view on SCHAYER's work as well to a more tempered style which did not totally reflect SCHAYER's own dashing manner of dealing with positions he disagreed with. In the meantime, I came also to notice some of the historical constellations which determined SCHAYER's private and fascinating intellectual life: in the beginning his studies of philosophy and indology in Germany during the 1920's, his refutation to study India as an Indo-Germanic myth, his objection against 'STCHERBATSKY's KANT-pervaded exegis of the Mādhyamika conception of the absolute' [42] and, in the end, the bitter story of all the suffering he and the whole Polish population had to bear from the brutal raid of Nazi Germany in 1939 on ([Kun57]). Stanislaw Schayer died in the age of fourty-two on tubercolosis, nevertheless delivering an impressing legacy to posteriority.

When Prof. MEJOR's answered to my question for his opinion on my paper ([Mej03b]), my first reaction was to try to integrate his views into my paper. After having realised that, due to an utterly different assessment of SCHAYER's work on Nyāya, this was impossible, I decided to include the main part of his diverging opinions without further comment from my side:

> "First we must keep in mind that Schayer's competence in the Sanskrit language and literature, and in particular in the history of Indian philosophy and religions, was outstanding. His works are cited by modern scholars continually and their author is rather praised for his acumen and great erudition than blamed for not always well balanced opinions. If one blames Schayer for his 'ahistorical' interpretations of the history of Indian logic this must be based on a grave misunderstanding: it seems that at the early thirties, notwithstanding his young age, Schayer was regarded as one the leading scholars in the field of Indology and certainly the pioneer of the study of 'new logic'. I think that one will not make a mistake saying that thanks to his three short studies on Indian logic a new topic was initiated and a new path was paved, to be continued with success by Ingalls, Matilal and others. Bocheński in his 'sketch of Indian variety of logic' heavily relied on informations brought to him by C. Regamey, direct disciple of Schayer (deemed to be his successor at the Warsaw University), which evidently go back to Schayer's (and A. Kunst's, another disciple of Sch.) statements.
>
> It goes without saying, however, that one cannot place Schayer in the same line with Łukasiewicz and other 'professional' mathematicians and logicians. Certainly in his study of ancient Indian logic Schayer - well, with some enthusiasm - followed the leading scholar(s) in the field of mathematical/formal logic and tried to adopt and adapt their findings. But at the same time it seems obvious that he could not compete with him/them in solving the most sophisticated problems - which, by the way, still provoke discussions among the scholars. And I am deeply convinced that Schayer as no other was fully aware of that! He should rather be regarded as a 'positive hero' in the battle for 'scientific philosophy' (whatever it could have been), a pioneer in the field of Indian logic, pointing out a new method of research and paving the way for the future research, and by no means as a one whose ambition was to become *primus inter pares*. It is sufficient to browse the relevant literature for the references to Schayer's works to see how much his works contributed to the development of Indology."

[42] [Kun57]

Prof. MEJOR provided me also with a copy of Stanisław SCHAYER's last paper "On the understanding of Other Cultures"[43]. This is a really impressive text in which the author trys to convey his conviction, that

> ... the most important condition for all understanding is indeed this conciousness of the multifaceted nature of human culture. There must be a consciousness that these forms in which we live are only one of the many possibilities and at last, that none of the concrete cultures is an absolute culture. Only all the manifest forms in the history of those, who have been, are, and will be, will create this absolute culture.

And, one page later, he states that

> ... in the sphere of the humanities and, in particular, in the area of learning about different cultures, there is no chance of 'progress'. If despite that, we say, for example, today after one hundred and fifty years of research on ancient Indian culture, we understand the culture more deeply, it only means that we have revised a lot of different views on that culture. It means that we have already looked at it from many different points of views and that each time other aspects have emerged from it, which, basicly were our very own aspects.

I cannot but agree with each and every word of this text. It shows very clearly the immense change Schayer's opinions underwent during less then a decade and the maturity he had attained. Considering this last text of Stanisław SCHAYER, I am now almost sure that he might even have agreed with parts of my critique of his early work on Nyāya.

References

[Adj35] Kasimir Adjukiewicz. Der logische Antiirrationalismus in Polen. *Erkenntnis*, 5, 1935.

[BM99] Piotr Balcerowicz and Marek Mejor, editors. *On the understanding of other cultures. Proceedings of an International Conference on Sanskrit and Related Studies to Commemorate the Centenary of the Birth of Stanisław Schayer (1899 - 1941)*, Studia Indologiczne 7 (2000), Warsaw, 1999. Instytut Orientalistyczny, Uniwersitet Warszawski.

[BM01] Piotr Balcerowicz and Marek Mejor, editors. *Materials of the International Seminar 'Argument and Reason in Indian Logic'*, Warsaw, 2001. Instityt Orientalistyczny, Uniwersitet Warszawski.

[Boc56] I. M. Bochenski. *Formale Logik.* 1956.

[Bor70] L. Borkowski, editor. *Jan Lukasiewicz. Selected Works.* North Holland, Amsterdam, 1970.

[Cor73] J. Corcoran. Completeness of an Ancient Logic. *Journal of Symbolic Logic*, 37(4):696–702, 1973.

[Gan01] J. Ganeri, editor. *Indian Logic. A Reader.* Curzon, Richmond, 2001.

[Hal92] W. Halbfass. *On Being and What There is.* State University of New York Press, New York, 1992.

[Kun57] Arnold Kunst. Stanisław Schayer (8.V.1899-1.XII.1941). *Rocznik Orientalistyczny*, 21:19–27, 1957.

[Lu35] Jan Łukasiewicz. Zur Geschichte der Aussagenlogik. *Erkenntnis*, pages 11–131, 1935.

[Lu57] Jan Łukasiewicz. *Aristotle's Syllogistic*. Clarendon Press, Oxford, 2. edition, 1957.

[43] [Sch39], also published in [Sch88], p. 313-321. English translation by Wanda Wyporska in [BM99], p. 35 -41.

[Lu63] Jan Łukasiewicz. *Elements of Mathematical Logic*. Pergamon Press, 1963. 1st ed. Warsaw 1929.

[Mar94] Witold Marciszewski. A Jaskowski-Style System of Computer-Assisted Logic. In Jan Woleński, editor, *Philosophical Logic in Poland*. Kluwer, Dordrecht, 1994.

[Mej03a] Marek Mejor. Contribution of Polish Scholars to the Study of Indian Logic. *Journal of Indian Philosophy*, 31(1-3):9–20, 2003.

[Mej03b] Marek Mejor. Private letter. December 2003.

[Oet94] Claus Oetke. *Vier Studien zum altindischen Syllogismus*. Wezler, Reinbek, 1994.

[Pat63] Günther Patzig. *Die aristotelische Syllogistik. Logisch-philologische Untersuchungen über das Buch A der Ersten Analytiken*. Vandenhoeck und Ruprecht, 1963.

[Sch32] Stanisław Schayer. Studien zur indischen Logik. I. Der indische und der aristotelische Syllogismus. *Bulletin International de l'Academie Polonaise des Sciences et de Lettres, Classe de Philologie, Krakow*, (4-6):98–102, 1932. Transl. into English in Ganeri (2001), p. 93-101.

[Sch33] Stanisław Schayer. *Über die Methode der Nyāya-Forschung*, pages 247–257. Leipzig, 1933. Reprint in Schayer (1988). Translation into English in Ganeri (2001), p. 102-109.

[Sch39] Stanisław Schayer. O rozumieniu obcych kultur (On the Understandig of Other Cultures). *Przeglad Wspólczesny*, (1):121–129, January 1939.

[Sch88] Stanisław Schayer. In Marek Mejor, editor, *O filozofowaniu Hindusów. Artykuly wybrane*. Warzawa, 1988.

[Smi73] T. Smiley. What is a Syllogism? *Journal of Philosophical Logic*, 2:136–154, 1973.

[Tuc29] G. Tucci. *Pre-Diṅnāga Buddhist Texts on Logic from Chinese Sources*. Gaekwad Oriental Series. Baroda, 1929.

[Wol89] Jan Woleński. *Logic and Philosophy in the Lvov-Warsaw School*. Kluwer Academic Publishers, Dordrecht, 1989.