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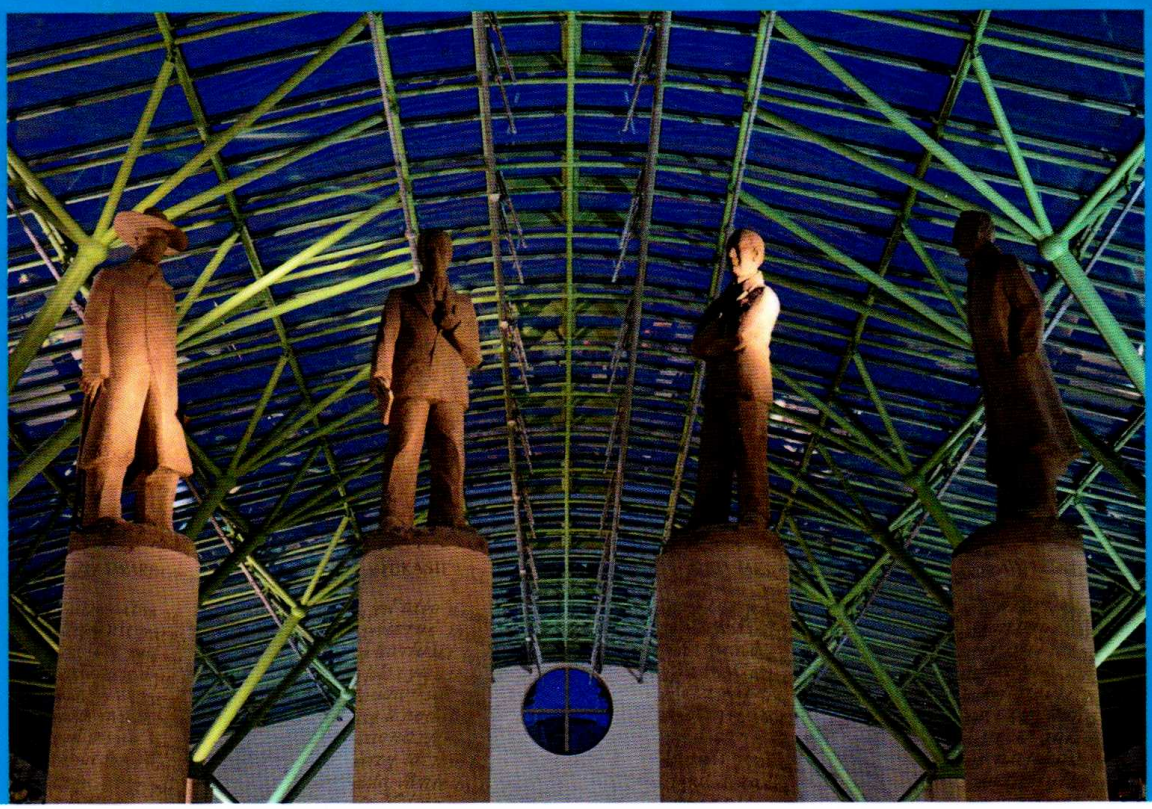
Polish Analytical Philosophy

Edited by Anna Brożek, Alicja Chybińska, Jacek Jadacki, Jan Woleński

Tradition of the Lvov-Warsaw School

Ideas and Continuations



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Poznań Studies in the Philosophy of the Sciences and the Humanities | *106*
Polish Analytical Philosophy

The volume aims to show the variety of research currents of the Lvov-Warsaw School and the ways in which these currents are developed today. The content of the book is divided into three parts. The first part provides an overview of the logico-semiotical achievements of the Lvov-Warsaw School. It also includes analyses of specific problems: categorial grammar, theory of truth, theory of reasoning and semiotic defects. The second part presents some metaphysical and ontological views of Twardowski, Kotarbiński, Ajdukiewicz, Bocheński and Lejewski. In the third part, specific features of psychological and sociological branches of the Lvov-Warsaw School are discussed.

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Cover illustration: The statues of (from the left) Twardowski, Łukasiewicz, Tarski, and Leśniewski, by Adam Myjak, situated in the vestibule of the Main Library of the University of Warsaw. Photo: Biuro Promocji UW.

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INTRODUCTION

The present volume aims to show the variety of research currents of the Lvov-Warsaw School and ways in which these currents are developed today.

1. The well known branch of investigations within the Lvov-Warsaw School is the logical one. Logical and semiotic research of the School are reminded and developed in papers gathered in the first section of the volume.

Jan Woleński's paper "Achievements of the Warsaw Logical School" is a survey through the logical results of Jan Łukasiewicz, Stanisław Leśniewski, Alfred Tarski and other Polish logicians. These results were so significant that Poland was treated before the 2nd world war as the leading country in the domain of formal logic.

One of important results of Kazimierz Ajdukiewicz was his categorial grammar. Wojciech Buszkowski's essay "Syntactic Categories and Types" confronts Ajdukiewicz's approach to syntactic categories with modern version of categorial grammar, mainly AB-grammars (basic categorial grammars) and Lambek grammars, *i.e.* categorial grammars based on various versions of the Lambek calculus.

In the paper "Truth-Theories in the Lvov-Warsaw School" Jan Woleński describes the Lvov-Warsaw School contribution to aletheiology. Besides the Tarski's definition of truth for formal languages which is the best known element of this contribution, the paper refers to discussion on perenniality of truth and the line of defence of absoluteness of truth by Polish philosophers.

The article "Questions and Cognition" by Anna Brożek develops two ideas of the theory of questions which appeared in the orbit of the Lvov-Warsaw School: Ajdukiewicz's idea that questions conduct the processes of reasoning as well as Tadeusz Kubiński's and Andrzej Wiśniewski's idea of erotetic reasoning, namely reasonining with questions as premises and conclusions.

Alicja Chybińska's article "Ajdukiewicz on Semiotic Defects" discusses Ajdukiewicz's contribution to the problem of semiotic correctness of speech. It also gives examples of how Ajdukiewicz applied theory of semiotic defects to explicate and sometimes even resolve philosophical problems.

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2. The second, ontological, section of the volume contains five articles.

It begins with two papers on Kazimierz Twardowski's philosophy. In the first one, entitled "Kazimierz Twardowski's on Metaphysics" Ryszard Kleszcz reconstructs Twardowski's views on the object and methods of metaphysics as well as his general view of philosophy and its relation to worldview.

In the second, entitled "Kazimierz Twardowski on Philosophy and Science" Anna Brożek concentrates on the relation between philosophy and sciences as depicted by Twardowski. The paper reconstructs Twardowski's view on different competences of these two areas of human thought, indicates the sources of Twardowski's interests in natural sciences and his contribution to general methodology.

Next two articles in this section are concerned with reism as one of the most original metaphysical conceptions which appeared in the Lvov-Warsaw School.

Mariusz Grygianiec's paper "On Czesław Lejewski's Ontology" presents some philosophical achievements of Czesław Lejewski as a metaphysician and a defender of reism. It provides an outline of Lejewski's extended version of reism and some of his metaphysical inquiries, and examines the defensive strategy of reism used by Lejewski. It also contains an argument against reism and a general assessment of Lejewski's efforts in the context of his defence of reistic ontology.

Marta Zaręba's article "On Tadeusz Kotarbiński's Reism and Praxiological Theory of Action" contains an analysis of the doctrine of reism in the context of the theory of agency that was developed by Tadeusz Kotarbiński based on praxiology. It characterizes reism and phases of its development, and gives an answer to the question of whether Kotarbiński's theory of agency can be reconciled with reistic ontology and/or formulated in accordance with the assumptions of semantic reism.

In the last article of this section, "Applying the Theory of Kazimierz Ajdukiewicz and Józef M. Bocheński to the Formulation of an Ontological Thesis" Aleksandra Horecka draws consequences from Bocheński's thesis: "Syntax mirrors ontology." She shows that, on the basis of different analyses of the formula: "Object *A* is endowed with property *P* in moment *t*," all contemporary ontological theses can be obtained. The article also presents a sketch of new, non-endurantistic semantics which are strictly connected with one of the ontological theories.

3. The third section of the volume is devoted to psychology and sociology in the Lvov-Warsaw School.

The opening paper "The Humanistic Traits of Psychology at the Lvov-Warsaw School," by Teresa Rzepa, presents the outline of psychological investigations in the Lvov-Warsaw School, shows their roots and

developments and provides their characteristic. According to the authoress, psychology of the school may be characterized by a predominantly humanistic understanding of the object of psychology and its research methods (introspection, intuition, interpretation) supplemented by two theses: that the main mechanism of human actions is the opportunity to make good changes and that a human being is capable of creative self-realisation.

The article of Wioletta Miśkiewicz, "Empirical Psychology in Lvov" reconstructs Twardowski's conception of psychology and describes the beginning and the development of experimental psychology in Lvov.

Piotr Surma in his text "Bronisław Bandrowski" presents scientific biography and analysis of philosophical and psychological views o Bronisław Bandrowski, one of the most promising members of the Lvov-Warsaw School, whose short life was tragically ended in Tatra Mountains.

Scientifc profile of another Twardowski's student interested in psychology, Stefan Baley, is presented by Stepan Ivanyk. In the article "Stefan Baley and the Lvov-Warsaw School" the author shows institutional and substantial connections between Baley and the Lvov-Warsaw School.

The next paper concerns some less known elements of Kazimierz Ajdukiewicz's heritage, namely his classification of mental acts. In the paper "Kazimierz Ajdukiewicz on Mental Acts" Natalia Miklaszewska presents and comments on the main ideas of classification of mental acts proposed by Ajdukiewicz, and compares it to other classifications proposed by members of the Lvov-Warsaw School.

The Lvov-Warsaw School influenced to some degree the area of sociology, mostly through Stanisław Ossowski. The paper of Jacek Jadacki, "Jakub Karpiński in the Orbit of the Lvov-Warsaw School," presents another important sociologist ideologically connected to the School, namely Jakub Karpiński.

The closing article, "Tradition of the Lvov-Warsaw School in the Second Half of 20th Century in Poland," Jacek Jadacki specifies main accomplishments of the Lvov-Warsaw School and shows how they are developed in contemporary Poland.

***

The volume is one of results of the project *The Significance of the Lvov-Warsaw School in European Culture*, realized in the program *Pomost-bis* of the Foundation for Polish Science.

Anna Brożek
Alicja Chybińska
Jacek Jadacki
Jan Woleński

LOGIC AND SEMIOTICS

Jan Woleński

ACHIEVEMENTS OF THE WARSAW LOGICAL SCHOOL[1]

1. Two Quotations and Remarks On the Circumstances in Which Logic in Poland Arose

There is probably no country which has contributed, relative to the size of its population, so much to mathematical logic and the foundations of mathematics.[2]

Boole and DeMorgan's ideas met with a response which the publications of Leibniz and his first followers had lacked. It is astounding how swiftly modern research in logic, once started, continued to develop; and how often hegemony shifted from one country to another. From Great-Britain it passed to the United States, where C.S. Peirce made important contributions. After 1880, Germany took over; here G. Frege and E. Schröder achieved great results. But by 1900, Italy was in the lead, thanks to the efforts of G. Peano and his co-editors of the *Formulaire de mathématiques*. Then Great Britain dominated once again, when A.N. Whitehead and B. Russell published their gigantic work, *Principia Mathematica* (1910–1913). After a new period of German leadership, due to Hilbert's influence, Poland took the lead.[3]

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[1] This article is a result of the project "The Significance of the Lvov-Warsaw School in European Culture" of the Foundation for Polish Science. It overlaps in some points with my earlier papers, namely (Woleński 1995), (Woleński 2003), (Woleński 2004), (Woleński 2008).

[2] Fraenkel and Bar-Hillel (1958), p. 200; references by the year of publication are always to the first edition, but page-references are to other editions or translations, if mentioned in the bibliography.

[3] Beth (1968), p. 63.

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How did it happen that a country without an especially strong tradition in logic so quickly (over the course of one generation) became a stronghold in this field? In particular, this qualification concerns the Warsaw School of Logic. This school was established by philosophers and mathematicians. In philosophy, everything goes to Kazimierz Twardowski, a student of Brentano and the founder of the Lvov-Warsaw School (see Skolimowski 1967, Woleński 1989 for extensive presentations of this movement; the second book contains an extensive survey of logic in the Lvov-Warsaw School). Twardowski (1866–1938) was appointed as a professor of philosophy at Lvov University in 1895. He wanted to introduce Brentano's metaphilosophical program in Poland. In particular, he demanded clarity of language and thought and believed in scientific philosophy. Twardowski was not a logician and did not consider himself as such. However, his metaphilosophical views formed a very friendly environment for logic *sensu largo*, that is, covering formal logic, semantics and the methodology of science. Twardowski lectured on the elementary algebra of logic in the 1899/1900 academic year. Jan Łukasiewicz (1878–1956) participated in this class and became attracted to logic. Łukasiewicz began systematic courses in the advanced algebra of logic. He trained many philosophers with explicit interests in logic, including Kazimierz Ajdukiewicz (1890–1963), Tadeusz Czeżowski (1889–1981), Tadeusz Kotarbiński (1886–1981) and Zygmunt Zawirski (1882–1948); all of them also studied mathematics, mostly under Wacław Sierpiński (1882–1969), who acquainted his students with set theory. Stanisław Leśniewski (1886–1939) joined this circle in 1910.

Warsaw appeared on the stage exactly in 1915, when the University of Warsaw was reopened; it had been closed in 1831 and functioned from 1862–1869 as the Warsaw Main School. The academic staff was mainly imported from Lvov. Łukasiewicz was appointed as a professor of philosophy. He began lectures in logic and attracted many young mathematicians. Poland recovered its dependence in 1918. This also resulted in a great debate about the tasks and prospects of Polish science and culture. Scholars in every field discussed how to develop their disciplines and what to do in order to catch up with world science. Particularly important was the discussion among mathematicians. In fact, it had already started in Lvov, but was rather private, involving Sierpiński and Zygmunt Janiszewski (1888–1920). Both had been disappointed by a lack of a common language and interests among Polish mathematicians and were convinced that set theory and topology should play a fundamental role in mathematics. The national discussion about science, its needs and perspectives, was a good occasion for developing views about the future of mathematics in Poland. Janiszewski became the main exponent of the project, later known as the Janiszewski program.

Roughly speaking, Polish mathematicians, according to Janiszewski, should concentrate on chosen mathematical fields and work in one strong circle. The second point was very soon abandoned, but the first was adopted. Although Janiszewski did not declare any concrete topic to be cultivated in Poland, most Polish mathematicians understood him to favour set theory, topology and their applications to other branches of mathematics. Janiszewski also postulated that Poland should have a special mathematical journal published in international languages. This idea found its realization in *Fundamenta Mathematicae* (the first volume appeared in 1920). Janiszewski's program attributed a great role to mathematical logic and the foundations of mathematics. The placement of logic and its foundations at the heart of mathematics required definite steps in the sphere of organization. The University of Warsaw had the Faculty of Mathematical and Natural Sciences. The Department of the Philosophy of Mathematics was very soon organized and Leśniewski became its head; Łukasiewicz left the University in 1918 in order to act as the Minister of Religious Confessions and Education in the government under Ignacy Paderewski. He returned to the academic staff in 1919 and the University established a special position for him in philosophy at the Faculty of Mathematics and Natural Sciences. Both professors began intensive teaching of mathematical logic, mostly among mathematicians but also among philosophers. The first project of *Fundamenta Mathematicae* divided the journal into two series, one devoted to set theory, topology and their applications, and second to logic and its foundations. This project was finally abandoned, but the significance of mathematical logic in the eyes of the founders of the Polish mathematical school found its impressive manifestation in the composition of the Editorial Board of *Fundamenta*: Mazurkiewicz, Sierpiński, Leśniewski and Łukasiewicz.

Alfred Tarski (1901–1983) started a list of young mathematicians and philosophers drawn to logic in Warsaw. The logic community in this city included (in alphabetical order and covering the whole interwar period): Stanisław Jaśkowski (1906–1965), Adolf Lindenbaum (1904–1941?), Andrzej Mostowski (1913–1975), Moses Presburger (1904?-1943), Jerzy Słupecki (1904–1984), Bolesław Sobociński (1904–1980; a philosopher by training) and Mordechaj Wajsberg (1902–1942?). The names of three other of logicians who graduated shortly before 1939 or studied during War World II and began their academic work after 1945 should be added to this list, namely Jan Kalicki (1922–1953; a mathematician), Czesław Lejewski (1913–2001; a classicist and philosopher) and Henryk Hiż (1917; a philosopher). The development of logic in Warsaw had two subperiods in 1918–1939, namely 1918–1929 and 1929–1939. The first decade consisted in intensive teaching and scientific work at the seminars of Leśniewski and

Łukasiewicz. Not many results were published at that time. The explosion of publications took place in 1929 and later.[4]

2. Logical Results and Ideas at the Warsaw School of Logic[5]

2.1. *Polish Notation and the Requirements For Logical Systems*

Łukasiewicz invented a parenthesis-free logical notation. The idea consisted in writing logical constants before their arguments, for instance, "$\vee pq$" instead "$p \vee q$." Łukasiewicz decided to replace the usual signs for logical operations by letters: *N* (negation), *K* (conjuction), *A* (disjunction), *C* (implication) and *E* (equivalence). Any well-formed formula (the present explanations are restricted to propositional calculus) must begin with a capital letter (propositional variables are symbolized by small lower case Latin letters) which refers to the main functor of the entire formula. The main connective has as its arguments, variables or formulas consisting of variables and constants. The first case is represented by the formula *Cpp* ($p \Rightarrow p$), the second by the formula *CCppNq* ($(p \Rightarrow p) \Rightarrow \neg q$). There is a simple purely syntactic criterion which allows one to decide whether a given sequence of signs is a well-formed formula or not. It says that in any 'wff' (a) the entire sequence must have more occurrences of lower case letters than capitals, and (b) every proper initial segment of the sequence must contain at least as many occurrences of capitals as occurrences of lower case letters. The structure of a formula (and hence, its meaning too) in Polish notation is uniquely determined by the position of letters. The parenthesis-free notation is unambiguous in the sense that any finite sequence consisting of symbols for connectives and variables is interpretable in a unique way. This implies that any wff coded in Polish notation has only one translation in standard symbolism. The main advantage of Polish notation is its economy because it avoids special punctuation devices such as brackets or dots.

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[4] Compare bibliographies in (McCall 1967), (Woleński 1989), (Jadacki 2009), (Murawski 2014).

[5] The presentation is selective and simplified at some points and certain results will only be listed without entering into details. I will also omit bibliographical details (compare note 4). McCall (1967) contains a selection of works by Łukasiewicz, Leśniewski, Sobociński, Ajdukiewicz, Jaśkowski, Wajsberg, Słupecki and Chwistek, and a survey, Jordan (1945). Tarski (1956), Łukasiewicz (1970), Wajsberg (1977), Mostowski (1979), Tarski (1986) and Leśniewski (1992) are collections of papers of their authors.

The parenthesis-free symbolism was closely associated with some ideas of Polish logicians concerning the good properties of formal systems. Of course, any correct logical system should be consistent and, if possible, syntactically and semantically complete. It should also be based on independent sets of primitive terms and axioms. The Warsaw School of Logic strongly emphasized the last property, often considered as secondary. Thus, the dependence on primitive terms or axioms was regarded as an essential defect. Moreover, some additional structural properties of logical systems were recommended, namely: (a) a system with fewer primitive concepts is better; (b) a system with fewer axioms is better; (c) if we define the length of an axiom system as the number of symbols occurring in all of its axioms, the shortest axiom system is the best; (d) a system with fewer of different symbols is better; (e) if we define an organic theorem as one which has no other theorem inside it (for example, the formula *CpCqq* is not an organic theorem), organic axioms are better than non-organic ones. Thus, the ideal axiom system consists of a sole organic axiom of the shortest possible length, provided that it is consistent. Requirements (a)–(e) apply particularly well to propositional calculus. They became the guiding principles of many logical investigations in the Warsaw School of Logic (examples below).

2.2. *Making Precise Some Metalogical Concepts*

The Warsaw School of Logic also made precise many important metalogical concepts considered as concretizations of general metamathematical notions. Probably the most important concept introduced is that of the logical matrix. A matrix is an ordered quadruple $\mathbf{M} = \langle X, Y, f, h\rangle$, where X, Y are sets of arbitrary elements and $X \cap Y = \emptyset$, f is a function of one argument and h is a function of two arguments. Both functions are defined on $X \cup Y$ and take values from this union. The set X is called the set of designated values. **M** is a normal matrix if the assumption that $x \in B$ and $y \in A$, entails that $f(x, y) \in A$. If we take $X = \{\mathbf{0}\}$, $Y = \{\mathbf{1}\}$ and define $f(\mathbf{1}) = \mathbf{0}$, and $h(x, y) = \mathbf{1}$, if $x \leq y$, otherwise $h(x, y) = \mathbf{0}$, we obtain truth-tables for negation and implication. The condition of normality means here that implication with a true antecedent and a false consequent is false. It also entails that a matrix in which $X = Y$ is not normal. If sentences are elements of X and Y, we obtain Lindenbaum algebra. The set of true sentences in a matrix **M** is called the content of this matrix and is denoted by the symbol **E**(**M**). Lindenbaum proved that (a) if **M** is a normal matrix, then **E**(**M**) is a deductive system, and (b) every deductive system has at most a denumerable normal matrix. Tarski showed that every propositional calculus has an axiomatic base with n elements, for every natural n. These concepts and

theorems were used in proofs of many metalogical theorems. The concept of the normal matrix is a prototype of the concept of a model, and that (b) is a version, restricted to propositional calculus, of the completeness theorem in the form: every consistent system has a model. Moreover, Warsaw logicians offered the definition of a logical (deductive) theory as a set closed by the consequence operation (see I. below)

2.3. *The Full* (*Functionally Complete*) *Classical Propositional Calculus*

Łukasiewicz formulated several axiomatic bases for functionally complete propositional calculus, that is PC in which all 16 connectives can be defined. The most popular is the *N*-*C* system, having as axioms, the formulas: *CCpqCCqrCpr*, *CCNppp*, *CpCNpq*, and the rule of substitution, the rule of detachment and the rule of definitional replacement as inference devices; the last rule states that definitions are regarded as metalinguistic abbreviations. This system is consistent, independent, Post-complete (= semantically complete): all properties were proved by Łukasiewicz and his collaborators. Of course, these properties had also been proven for different bases by other logicians, in particular, Post and Bernays; however, Łukasiewicz showed that the axiom system adopted by Frege, Hilbert and the authors of *Principia Mathematica* were not independent.

According to the criteria mentioned in the preceding section, one should look for the simplest axiom bases. Łukasiewicz showed that the formula *CCCpqCCCNrNstrCuCCrpCsp*, having 23 letters, is the shortest possible axiom of the *N*-*C* system of propositional calculus. Special attention was devoted to the Sheffer function which can serve as the sole functor of propositional calculus (Sheffer found such a functor, Nicod found the first axiom). Łukasiewicz worked with the functor defined by the formula *Dpq* = *NKpq*. The Nicod axiom (N) *DDpDqr DDtDttDDsqDDpsDps* is not organic (it has the theorem *DtDtt* as its part). After many investigations, Wajsberg found the organic formula *DDpDqrDDDsrDDpsDpsDp-Dpq*, which is equivalent to (N). Another organic *D*-axiom was given by Łukasiewicz, namely the formula *DDpDqrDDpDrpDDsqDDpsDps*.

In 1926 Łukasiewicz, observed that because practical deductive inferences appeal to assumptions and rules, not to logical tautologies, logic should be presented as the system of rules leading from assumptions to conclusions. Hence, there arises the question of how to characterize logic by a set of rules. This problem was solved by Jaśkowski. He invented one of the methods of natural deduction that proceeded by supposing and deducing conclusions from given assumptions. Jaśkowski's original system is too complicated to describe in the present paper. The following example illustrates the procedure. We are looking for a rule which permits us to

deduce *q* from *Cpq* and *p*. Thus, we assume *p* and *Cpq* and further proceed by the rule of detachment. Moreover, it is possible to show that the tautology *CpCCpqq* is related to the rule of detachment, formulated only with the help of implication. Assume (a) *p*, and (b) *Cpq* As suppositions. Deduce *q* from (a) and (b). Since *q* is a consequence of *Cpq*, the formula *Cpqq* follows. Finally, (a) leads to *CpCCpqq*. Jaśkowski proved that the logic produced by his suppositional method is equivalent to that codified by the axiomatic method. He also applied his natural deduction to intuitionistic logic and predicate calculus.

2.4. *Partial Classical Propositional Calculi*

By a partial propositional calculus we understand a system which has no resources to define all connectives. The most popular are *C*-systems and *E*-systems, as investigated by Leśniewski, Łukasiewicz, Sobociński, Tarski and Wajsberg. Here are some axiom sets for the *C*-system:

(a) *Cpqp*, *CCpqCCqr Cpr*, *CCCpqrCCprr* (Tarski; Bernays replaced the third formula by *CCCpqpp* and the resulting system is called the Tarski-Bernays implicational logic);
(b) *CpCqCrp*, *CCCpqrCsrCCprr* (Wajsberg);
(c) *CCCpqpp*, *CCCCpqrsCCqrCps* (Wajsberg);
(d) *CpCqp*, *CCCCpqrs*, *CCqsCps* (Łukasiewicz). Łukasiewicz proved that the formula *CCCpqrCCrpCsp* is the single axiom of the *C*-system and that a formula of 13 letters is the shortest possible *C* axiom.

Leśniewski formulated the first axiomatic base for the *E*-system: *EEEprEqpEqr*, *EepEqr Eepqr*. Then, several single axioms were given by Wajsberg (for instance, *EEEpEqrEErss Epq*), Sobociński (for instance, *EepEqrEEpErsEsq*) and Łukasiewicz (for instance, *EepqEErq Epr*). Łukasiewicz proved that the length of the shortest *E*-axiom cannot be less than 10 letters. Leśniewski observed that a wff of *E*-calculus is an *E*-theorem if and only if every variable occurs an even number of times in it.

2.5. *The Propositional Calculus With Variable Functors*

The usual rule of substitution permits one to replace propositional variables by arbitrary well-formed expressions. Łukasiewicz proposed a generalization of this rule by introducing so-called substitution with apostrophe. He also changed his earlier view concerning definitions as metalinguistic abbreviations and interpreted them intralinguistically, that is, as theses of the system. Assume that the formula (a) *Cfxfy* is a definitional scheme, where the expressions *x* and *y* do not contain the functor *g*. We want to define the negation, that is, the formula *Np*. Allow that the symbol 0 denotes a false

sentence. We can define *Np* as (b) *ENpCp0*. Łukasiewicz proved that (b) can be replaced by (c) *CfNpfCp0*, that is, a special instance of (a). In order to justify this fact, one must prove that (c) implies (d) *CfpCfCp0fq*, and that (d) implies (a); (d) asserts that the formula *Np*, that is, our definiendum, may be replaced by the formula *Cp0*. In order to prove that (c) implies (d), we use a thesis (at the moment, one must assume its validity) (e) *CfpCfNpfq*, which means "if something is true about the sentence *p* and the sentence *Np*, it is also true about an arbitrary sentence *q*" (this reading shows that *f* is a variable functor of one argument, that is, expressing a monadic property predicated by arbitrary sentences). At first, we apply (c) to (e) and perform (in (e)) the substitution with apostrophe: *f*/*CfpCf'fq*. The expression after the stroke displays the structure of the expression in which the substitution is made, except that the second occurrence of the letter *f* is replaced by *f* apostrophe. It indicates that the implication *CfNpfq* may be replaced by the corresponding implication occurring in (c) and ending with the variable *q*; that is the formula *Cp0fq*. This operation yields (d). The system's variable functors allow implication to play the role of equivalence. Łukasiewicz proved that the axioms of the *C*-*N* system and propositional calculus with quantifiers (another extended propositional calculus) are deducible from (f) *Cf0CfC00fp* or (g) *CfC00CfC0fp* (together with the rule of apostrophic substitution and the rule of detachment). Both formulas express a form of the principle of bivalence. Carew A. Meredith, Łukasiewicz's student in Dublin, showed that the formula *Cff0fp* plus the usual rules for quantifiers, is sufficient as the single axiom for extended propositional calculus.

2.6. *Many-Valued Logic*

The discovery of many-valued logic is commonly considered as one of the major achievements of Łukasiewicz. He did it in 1917/1918, a little earlier than Emil Post. However, although Post's remarks were parenthetical and extremely condensed, Łukasiewicz explained his intuitions and motivations carefully and at length. He was guided by considerations about future contingents and the concept of possibility, closely related to the discussion about the eternality (if something is true, is true for ever) and sempiternality (if something is true, it was always true) of truth among Polish philosophers. The debate was initiated by Kotarbiński who, probably inspired by some views of Łukasiewicz about the principle of contradiction and the relation between the principle of contradiction and determinism, argued (in 1912) that this second law in the form, "every proposition is either true or false" is inconsistent with human freedom and creativity. He admitted propositions which are neither true nor false. This implies that truth is only

eternal, but not sempiternal. Leśniewski reacted with a criticism, pointing out that truth is eternal as well as sempiternal, that is, independent of time in both directions. He argued that the rejection of sempiternality would lead to inconsistency.

Łukasiewicz observed that no functor of classical propositional calculus could be read as "it is possible that" and provided the extensionality of the possibility operator (*M*). The difficulty can be solved, if we admit a third value. Sentences about future contingent states of affairs are natural candidates for having the third value ($\frac{1}{2}$). For example, the sentence "I will visit Warsaw next year" is neither true nor false; it is merely possible and has the value $\frac{1}{2}$. Its negation also has the same value. This idea led to three-valued logic. The usual equalities for *N*, *A*, *K* and *C* are supplemented by (I list only some cases) $p = \frac{1}{2} = Np$, $K\frac{1}{2}\frac{1}{2} = \frac{1}{2}$, $A\frac{1}{2}\frac{1}{2} = \frac{1}{2}$. Easy calculations shows that *ApNp* and *NKpNp* have the value $\frac{1}{2}$ for $p = \frac{1}{2}$. This means that the laws of contradiction and the excluded middle do not hold in three-valued logic. Later, Łukasiewicz generalized it to logic with an arbitrary finite number of values and finally to an infinitely countable number of values. The sense of implication is given by the equation: $Cpq = 1$ for $p \leq q$, $Cpq = 1 - (p + q)$ for $p > q$, and the sense of negation by the equation $Np = 1 - p$, were $0 \leq p \leq 1$. If we have only two values, these equations determine the usual truth-tables for *C* and *N*.

Three problems arose after discovering many-valued logic (see Malinowski 1993 for a survey). The first concerned its axiomatization and metalogical properties, the second its philosophical foundations and intuitive interpretation, and the third its applications. Due to the work of Łukasiewicz himself, Wajsberg and Słupecki, the first group of questions was largely solved. Wajsberg showed that the formulas: *CpCqp*, *CCpqCCqrCpr*, *CCNpNqCqp*, *CCCpNppp* axiomatize $Ł_3$ (three-valued propositional calculus). The same author proved that a finite $Ł_n$ is axiomatizable if it includes the theorems: *CCpqCCqrCpr*, *CCCqrCCpqCpr*, *CCqqCpp*, *CCpqCNqNp*, *CNqCCpqNq*. If $n = \aleph_0$, $Ł_n$ can be axiomatized by (Łukasiewicz's conjecture, proved by Wajsberg): *CpCqp*, *CCpqCCqrCpr*, *CCCpqqqCCqpp*, *CCCpqCqpCqp*, *CCNpNqCqp*. However, all of the above axiom-sets are functionally incomplete. The problem was solved by Słupecki for $Ł_3$. He introduced the new functor *T* defined by $T1 = T\frac{1}{2} = T0 = \frac{1}{2}$ and added the formulas *CTpNTp*, *CNTpTp* to Wajsberg's axioms. All many-valued logics of Łukasiewicz are consistent. Słupecki proved that $Ł_3$ is Post-complete. All $Ł_n$ ($n > 2$) are contained in two-valued logic, but not conversely; for example, formulas *CCNpNp*, *CCNppp, CCpqCCpNqNp*, *CCpKNqNp*, *CcpEqNqNq* are theorems in a two-valued system only. If $n = \aleph_0$, $Ł_n$ is contained in every finite $Ł_n$. Later, Mostowski (in the 1960s) also investigated the problem of the axiomatization of many-valued predicate logic using

topological methods. In particular, he proved that the complete set of axioms exists if the set of truth values is ordered and bicompact in its order topology. This is a non-effective result, which does not yield any concrete axiomatization.

At first, Łukasiewicz called his three-valued logic "Non-Aristotelian," but later he preferred the qualification "Non-Chrysippean." According to Łukasiewicz, the Stagirite himself doubted the validity of the principle of excluded middle in the domain of future contingents. On the other hand, the Stoics believed that every proposition was true or false, independently of its temporal reference. Thus, the Stoics accepted the principle of bivalence in its unrestricted form. Now, the foundation of two-or many-valued logic lies not in this or that logical theorem, but in metalogic; in particular, it is determined by accepting or rejecting the principle of bivalence. Whoever, as Chrisippus did, accepts the validity of the principle of bivalence, opts for two-valued logic; whoever, as Aristotle maintained, rejects, even partially, this principle, thereby opens the door for many-valued logic. Łukasiewicz took the side of Aristotle. However, this did not close the problem of the interpretation of other logical values. Łukasiewicz tried to go though indeterminism and causality. In particular, he used terminating and newly appearing causal chains. Others, for instance, Zawirski interpreted logical values as corresponding to degrees of probability. A typical difficulty is the following. Take p as valued by $\frac{1}{2}$. Its negation also has the value ½. The same holds for $KpNp$, contrary to the firm intuition that any pair of contradictory sentences is false. Difficulties with interpretation changed Łukasiewicz's primary view concerning the relation of many-valued logic to reality. At first, he was guided by realistic epistemology of logic, maintained that one of the rival logics could be proved as the correct description of the physical world. Later, he was rather inclined to look at logical systems as formalisms having their own problems deserving research and as useful devices for solving various questions but not as something leading to the only "true" ontological scheme. Yet he believed that many-valued logic would play a considerable role in the foundations of mathematics. At Łukasiewicz's time, many-valued logic had no applications in technology or artificial intelligence, as it does today.

2.7. *Modal Logic*

The analysis of possibility constituted one of the sources of many-valued logic. Thus, the step from many-valued logic to the logic of modalities was a natural one. However, Łukasiewicz did not build a real system of modal logic until the 1950s. He only gave some hints about how to think about modalities in the framework of many-valueness. For example, the

possibility of p, (Mp) can be defined as $CNpp$ in L_3 (this was Tarski's proposal). The rule of extensionality was the guiding principle here. Thus, the logical value of "it is possible (necessary) that p" must be a function of the value of p. The systems commonly called Ł-modal are based on the following intuitive principles (L is the symbol for necessity): (a) the implication $CpMp$ is accepted; (b) the implication $CMpp$ is rejected; (c) the sentence Mp is rejected; (d) the implication $CLpp$ is accepted; (e) the $CpLp$ is rejected; (f) the sentence NLp is rejected; (g) the equivalence $EMpNLNp$ is accepted; (h) the equivalence $ELpNMNp$ is accepted. The basic Ł-modal logic has as its axioms ($\vdash$ stands for acceptance, $\dashv$ stands for rejection):

(1) $CpMp$;
(2) $\dashv CMpp$;
(3) $\dashv Mp$;
(4) $EMpMNNp$

plus the rules of substitution (formulas obtained by the substitution of accepted formulas are accepted; if the substitution of x produces a rejected formula, then x is rejectable), the rules of detachment (if Cxy is accepted and x is accepted, then y is accepted; if Cxy is rejected and y is rejected, then x is rejected) and the rules of replacement related to (g) and (h). The full modal logic is given by the axioms:

(I) $\vdash CfpCfNpfq$;
(II) $\vdash CpMq$;
(III) $\dashv CMpp$;
(IV) $\dashv Mp$

plus the rules of the basic Ł-modal system; the idea of variable functors is employed in (I). The semantics for the basic Ł-modal system is given by four-valued logic. Thus, after a long journey, $Ł_4$ appeared the most natural to Łukasiewicz; formerly, he had believed that the choice concerned two-valued logic and $Ł_n$ with $n = \aleph_0$.

Here are the main differences between Ł-modal logic and Lewis-type modal systems (S-systems): (a) Ł-systems are extensional, S-systems are not; (b) Ł-system have finite characteristic matrices, S-systems do not; (c) Ł-systems has no theses beginning with L. Polish logicians also worked on S-systems. The principal results are the following. Wajsberg formulated (in 1933) the first semantics for S_5 and proved the completeness of this system. In the 1950s and 1960s, Sobociński proved the equivalence of T (Feys' modal system) and M (von Wright's modal system), the equivalence of M' and M'' (both also due to von Wright) with S_4 and S_5, that T has infinitely many different modalities and he defined the family of K systems which are extensions of S_4 but are weaker than S_5. Tarski (in collaboration

with McKinsey and Jónsson) pointed out links between modal logic, topology and Boolean algebras, particularly in semantics.

2.8. *Intuitionistic Logic*

Although no Polish logician was an adherent of intuitionism as a philosophical standpoint, intuitionistic logic, as a formal construction, was intensively investigated in Poland. The most important result was obtained by Jaśkowski. Lindenbaum, as I already noted in section A, proved that every propositional calculus has a denumerable characteristic matrix. On the other hand, Gödel demonstrated (in 1932) that there is no finite characteristic matrix for intuitionistic propositional calculus. Both results yield the conclusion that the adequate matrix for this logic must be denumerably infinite. It remained to construct it. This was done by Jaśkowski in 1936. The construction consists in defining an infinite sequence of matrices by transitions from n-valued to $n + 1$-valued ones. The product of all the matrices of this sequence gives the single infinite matrix which is characteristic of intuitionistic propositional calculus; that is, it verifies all its theorems.

Other results include (a) topological semantics for intuitionistic logic (Tarski together with McKinsey; these constructions are developed in Rasiowa and Sikorski 1963 and Rasiowa 1974); (b) the separation theorem (Wajsberg in 1938), which shows that N and one member of the set $\{C, A, K\}$ does not suffice to define any other member of it (in classical logic the definability holds); (c) the theorem (Tarski) that classical propositional calculus is the only maximally consistent extension of propositional logic; (d) Mostowski's lattice-theoretical proof that some formulas are non-deducible in intuitionistic predicate logic. The fact that intuitionistic propositional calculus is weaker than classical calculus was well known (see (c) above); (e) the proof (Lindenbaum and Tarski) that classical propositional logic is the only maximally consistent extension of intuitionistic logic). However, Łukasiewicz showed that if we take intuitionistic logic with variable functors, the situation changes and it is possible to deduce all classical tautologies. Łukasiewicz's result shows how strong logic with variable functors is.

2.9. *Paraconsistency*

Łukasiewicz argued (in 1910 on the occasion of studying the Aristotelian approach to contradiction) for the dispensability of the principle of contradiction in correct logic (deductive). This was the first observation related to what is presently called paraconsistency today. Jaśkowski, inspired not only by Łukasiewicz but also by Hegelian and Marxist interpretations of dialectical contradictions, elaborated a related logic in the 1940s and early

1950s. Jaśkowski gave two reasons for looking for a logic that tolerates inconsistencies. The first appeals to the frequent occurrence of contradictory statements in ordinary language, mostly to vague formulations. Secondly, the use of contradictory hypotheses is often forced by explanations of phenomena in theoretical science. Jaśkowski concluded that we need a logic that organizes cognition by availing itself of mutually incompatible statements. Formally speaking, the system which we are looking for must avoid being overfilled in the case of the occurrence of a contradiction. A system is overfilled if and only if any well-formed formula is its theorem. Classical propositional logic is overfilled due to the theorem *CKpNpq*, provided that *p* an *Np* are its theses.

Jaśkowski's logic (discursive logic) is based on the concept of discursive implication, C_dpq, defined by the formula *CMpq* in a modal logic M_2 related to the system S_5. The discursive equivalence E_dpq is defined by *KCMpqCqMp*. Every theorem of classical propositional calculus having no other connectives than *C*, *E* and *A* becomes a theorem of the discursive logic D_2 if *C* is replaced by C_d and *E* by E_d. If *x* is a theorem of classical logic and includes no other connectives than *A*, *K* and *N*, then *x* and C_dNxq are theorems of D_2. Furthermore, prefixing any D_2-theorem by *M* yields a D_2-theorem. The formulas *NKpNq* (the usual principle of contradiction) and C_dKpNpq (the discursive law of overfilling) are D_2-theorems. However, the formulas C_dpC_dqKpq and C_dpC_dNpq are not valid and this fact prevents overfilling. The system D_2 is the first mature paraconsistent system of logic.

2.10. *Metamathematics*

Polish logicians did a lot of work in metamathematics. Perhaps the theory of consequence operations is the most characteristic achievement in this domain. The consequence operation as a mapping from 2L to 2L, is usually defined by (1) $A \in Cn(X)$ if $X \vdash A$ (*A* is a logical consequence of the set *X* if and only if *A* deducible from *X*). It is also possible to take the concept of logical consequence as a primitive one and establish its properties by axioms. Since we have infinitely many mappings from 2L to 2L, some constraints upon selecting a "reasonable" consequence operation (or operations) are indispensable. This was due to Tarski, who characterized the consequence operation associated with the classical propositional calculus by the axioms:

(1) $\emptyset \leq L \leq \aleph_0$;
(2) $X \subseteq CnX$;
(3) if $X \subseteq Y$, $CnX \subseteq CnY$;
(4) $CnCnX = CnX$;

(5) if $A \in CnX$, then $\exists Y(Y \subseteq X \wedge FIN(Y) \wedge (A \in CnY))$;
(6) if $B \in Cn(X \cup \{A\})$, then $(A \rightarrow B) \in CnX$;
(7) if $(A \rightarrow B) \in CnX$, then $B \in Cn(X \cup \{A\})$;
(8) $Cn\{A, \neg A\} = \mathrm{L}$;
(9) $Cn\{A\} \cap Cn\{\neg A\} = \varnothing$.

Tarski considered *Cn* as a closure operation and was guided by topological ideas.

> Axioms (1)–(9) can be divided into two groups. The first includes (1)–(5) as general axioms for *Cn*. They establish respectively the cardinality of L as at most denumerable, the containment of any set in the set of its consequences, and the monotonicity, idempotency and finiteness of *Cn*. The general axioms do not provide any logic in its usual sense; presently, they or their variations (for example, admitting non-denumerable languages or dropping certain conditions, in particular monotonicity) define so-called abstract logics. The logical machinery is encapsulated by the rest of the axioms (related to logic based on negation and implication). (6) is the deduction theorem, (7) states a version of the rule of detachment (both axioms determine the meaning of classical implication), (8)–(9) characterize negation. This approach was later generalized by Tarski as the calculus of logical systems.

Let me list other metamathatical results obtained by logicians from the Warsaw School of Logic. They include the deduction theorem (Tarski), the elimination of quantifiers (Tarski, Presburger), the arithmetical hierarchy (Mostowski), generalized quantifiers (Mostowski), the completeness and decidability of elementary geometry and elementary number theory, the upward Löwenheim-Skolem theorem (Tarski), the Lindenbaum maximalization lemma (Lindenbaum), the axiom of choice, the continuum hypothesis and other problems in the foundations of set theory (Tarski, Lindenbaum, Mostowski), Boolean algebras (Tarski), or various results on deductive systems, for instance, if we take into account all deductive systems, they can be considered as an interpretation of Boolean algebra, but the set of all consistent systems is a counterpart of Pseudo-Boolean algebra associated with an intuitionistic role.

If we consider model theory as a part of metamathematics, Tarski's famous semantic definition of truth originated this kind of logical studies. Tarski, inspired by philosophy (see above) provided a mathematically precise definition of the concept of truth. More precisely, he defined in the metalanguage the class of true sentences for a given language L. This definition does not suffer from the Liar paradox and other semantic antinomies. According to Tarski the formula '*A*' is true if and only if *A*, where the symbol '*A*' represents the name of a sentence *A*, expresses the basic intuition of the classical (Aristotelian) truth-definition. Tarski proved that if *S* is a deductive theory and its expressive power is enough for capturing the arithmetic of natural numbers (Peano arithmetic), the set of true sentences

of *S* is not definable in *S* (the Tarski undefinability theorem). This theorem constitutes one of the deepest limitative theorems. Kurt Gödel showed how to arithmetize metamathametics, that is, how to translate metamathematical statements into the language of arithmetic. In particular, every provable arithmetical statement has its unique Gödel number. Call it a provable number (of a formula *A*). What about true Gödel numbers? Tarski's theorem shows that the set of true numbers is more extensive that the set of provable numbers and that the gap between both is essential and cannot be liquidated by syntactic methods. This means that semantics is richer than syntax.

2.11. *Leśniewski's Systems*

Leśniewski intended to formulate the full logical system that would serve as the base for the whole of science, and in particular for mathematics. This system consists of three parts:

(a) protothetic (a generalized propositional calculus);
(b) ontology (a logic of terms);
(c) mereology (a theory of parts and wholes).

Protothetic is a calculus with quantifiers binding propositional variables and variables referring to arbitrary functors constructible over usual functors: that is, the functors of propositional variables, the functors of functors, *etc*. In general, protothetical quantifiers bind variables of all definable categories, if we start with the category of sentences alone. Leśniewski required that the axioms of protothetic be expressed with the help of equivalence (or implication) as the sole primitive. Tarski (in 1923 in his PhD dissertation) showed that negation and conjunction are definable by equivalence and the universal quantifier. This was an important step toward the successful construction of protothetic. The shortest axiom of protothetic (written in Russell's symbolism adapted to the needs of Leśniewski's systems) is the formula $[pq] :: p \Leftrightarrow . q \Leftrightarrow :.[f]:. f(pf(p\ [u].\ u)). \Leftrightarrow : [r]: f(qr). \Leftrightarrow . q \Leftrightarrow p$; it was founded by Sobociński). Protothetic is consistent. Its elementary part, that is, with quantifiers binding propositional variables only, is Post-complete (Słupecki). Protothetic is an absolute propositional calculus in the sense that the principle of bivalence is its theorem. In fact, protothetic inspired Łukasiewicz's system with variable functors, another absolute propositional logic.

If we add the functor ε (read as "is") forming sentences by the addition of two names, we obtain Leśniewski's ontology (LO). The meaning of the constant ε is perhaps the most important matter for the proper understanding of LO. The epsilon well corresponds to the sense of the copula "est"

in the Latin sentence "Socrates est homo." The epsilon has no spatio-temporal connotations; does not indicate membership relation or identity. The rendering of the epsilon by the English "is" may be misleading, because the latter is modified by articles. Thus, there remains an axiomatic characterization of the meaning of ε. It is given by the formula

(O) $[Aa]:: (A \varepsilon a) \Leftrightarrow :.[\Sigma B]. (B \varepsilon a):. [BC]: (B \varepsilon A). (C \varepsilon A). \Rightarrow (B \varepsilon C):. [B]: (B \varepsilon A) \Rightarrow . B \varepsilon a.$

Its simplified form (established by Sobociński) is

(O') $[Aa]\ A \varepsilon a: \Leftrightarrow .[\Sigma B]. (A \varepsilon b). (B \varepsilon a).$

The right sides of (O) and (O') are conjunctions. The intuitive content of (O) is simple in spite of its formal complexity. It established that the sentence "*A* is *a*" is equivalent to the following conditions (a) *A* is not empty term; (b) there is only one *A*; (c) whatever is *A*, is also *a*. Thus, "*A* is *a*" is a singular sentence which is true if and only if (a)–(c) hold. In particular, such a sentence is false if *A* is a general or an empty term. On the other hand, (O) (or (O') is valid for all terms, including general or empty ones. Thus, LO is valid in all domains, including the empty one and can be regarded as the first system of free logic. In LO we can define two important concepts namely that of existence and that of being an object. This is done by (I use non-symbolic forms): (1) for any *A*, *A* exists = for some *x*, *x* is *A*; (2) for any *A*, *A* is an object = for some *x*, *A* is *x*. LO performs functions usually provided by predicate logic. The meaning of the constant ε is sufficiently general to define identity and the inclusion of classes. The label "ontology" as denoting LO was justified by Leśniewski by pointing out that this system can be interpreted as a general theory of objects.

Mereology, assumes protothetic and ontology as logically prior theories, and has the term "part of" as its sole primitive concept. It can be axiomatized (this is one of the possibilities) by (in an infomal manner): (a) if *P* is a part of *Q*, then *Q* is not a part of *P*; (b) if *P* is a part of *Q* and *Q* is a part of *R*, then *P* is a part of *R*; (c) if every *a* is the same object as *P* or is a part of *P*, if every *a* is the same object as *Q* or is a part of *Q*, and for any *R* – if *R* is a part of *P* or a part of *Q*, then a certain object which is the same object as *R* or is a part of *R* or a part of some *a* – then *P* is *Q*; (d) if a certain object is *a*, then for some *P*, (i) for any *Q*, if *Q* is *a*, then *Q* is the same as *P* or is a part of *P*, and (ii) for any *Q*, if *Q* is a part of *P*, then a certain *x*, which is the same object as *Q* or a part of *Q*, is *a* or a part of some *a*. Furthermore, we have the definitions (e) *P* is an ingredient (element) of *Q* if and only if *P* is the same object as *Q* or a part of Q; (f) *P* is a class of objects *a* if and only if (i) *P* is an object, (ii) for any *Q*, if *Q* is *a*, then *Q* is

an ingredient of P, (iii) for any Q, if Q is an ingredient of P, then a certain ingredient of Q is an ingredient of certain a.

Axiom (a) defines being a part as a non-reflexive relation; that is, being a proper part. An ingredient of Q is Q or its proper part. The axiom (b) establishes that being a part is a transitive relation. In virtue of (f) there are no empty classes. Moreover, the class consisting of a single element is identical with it. In general, mereology is a theory of sets in the collective (mereological) sense, contrary to ordinary set theory, which describes sets in the distributive sense. The main difference of both interpretations of the term "set" consists in the fact that the membership relation is transitive under the mereological reading, but non-transitive under the distributive one. Leśniewski believe that his theory classes would perform all the tasks of ordinary set theory without generating paradoxes. In fact, he invented mereology when he tried to solve the Russell paradox. It follows for the meaning of the terms "class" and "element" as established by (a)–(f) and without further additions there are no classes which are not their own elements. Hence, the question which led to the Russell paradox simply makes no sense in Leśniewski's systems.

Leśniewski's systems have some formal features, even very peculiar ones in some respects. All are axiomatic. According to his nominalistic preferences, they are concrete physical objects. Expressions are always understood as sequences of concrete inscriptions. There are as many expressions as have been written; no expression exists merely potentially. This view is called constructive nominalism. According to it, two intuitively equivalent systems, for example, protothetic based on equivalence and protothetic based on implication, are different systems. Every logical system, in Leśniewski's view, is not finished at any time because there is always the possibility of adding new elements to it. Hence, the rules for constructing and developing formal systems are of crucial importance for Leśniewski's logics. He understood this very well and devoted much attention to explaining the details of his formalization. Leśniewski formulated his procedural directives purely syntactically and completely. Due to the role of equivalence, he was able to treat definitions as theorems. In general, Leśniewski's systems are commonly considered as perfect from the point of view of the requirements of correct formalization.

The Leśniewski project is a version of logicism. Leśniewski's three systems form a grand logic and provide a universal language to capture the whole of knowledge. It is certainly not an orthodox system and lies on the margin of contemporary research in logic. Yet it continues to attract many logicians and philosophers. In spite of their marginality, Leśniewski's systems are investigated in all parts of the world. Two kinds of problems are advanced (see Luschei 1962, Urbaniak 2013 for extensive presentation

of Leśniewski's systems and their problems). The first concerns interpretation. Is mereology a logical or extralogical theory? How strong is mereology in comparison with standard set theory? What is the relation of mereology to Boolean algebra? How should quantifiers be interpreted in LO? What is the relation of LO to quantification theory? How to subject Leśniewski's logic to the standard metamathematical treatment using infinitary methods? What is the relation of the grammar of Leśniewski's languages to the theory of logical types? It is established that mereology is weaker than set theory. On the other hand, elementary ontology is stronger than first-order logic. In particular, one can define identity in elementary LO, but it is impossible to do so in elementary logic.

Leśniewski played a central role at the Warsaw School of Logic. Most young scholars co-operated with him in building protothetic, ontology and mereology. Lindenbaum and Wajsberg are to be added to Tarski, Sobociński and Słupecki, who were earlier mentioned. After 1945 Sobociński and Lejewski created powerful centres of study about Leśniewski's logic. Many of his ideas circulated in Warsaw and influenced logical research at the Warsaw School of Logic. He formulated the requirements of correct logical systems. Traces of intutitive formalism and constructive nominalism are easy to find in the works of Tarski and Łukasiewicz. Leśniewski gave the standard diagnosis of semantic antinomies and outlined the way to solve them. These ideas were heavily used in Tarski's theory of truth. Even some details of Jaśkowski's version of natural deduction (it is presented as an expanding system) are impossible to understand without appealing to Leśniewski's idea of deductive systems.

One influence should be especially noted. It concerns the theory of syntactic categories developed by Ajdukiewicz in the early 1930s. He adopted the categories of sentences and names (for Ajdukiewicz, following Leśniewski, there is no syntactic difference between proper names and common nouns) as fundamental and assigned the pointer *s* to sentences and *n* to names. Now functors have fractions as pointers. For example, "is" has *s*/*nn* as its categorial index; it says that "is" is a two-placed functor of two nominal arguments which forms a sentence. The conjunction as a propositional connective, forming sentences from two other sentences, has *s*/*ss* as its index. Consider now the expression "*p* and *q*." Write the categorial indexes of its parts. We thus obtain the sequence: *s s*/*ss s*. Perform simplifications by divisions similar to dividing algebraic fractions. The letter *s* is the result. A simple algorithm says that an expression is syntactically coherent if and only if *s* or *n* is its index after performing all simplifications. Ajdukiewicz's quasi-arithmetical notation was the first system of categorial grammar.

2.12. *The History of Logic*

Łukasiewicz revolutionized the history of logic. He proposed looking at the history of logical ideas through the lens of mathematical logic. The reason was that he was convinced about the continuity of formal logic from Aristotle to modern mathematical logic, perhaps with a break from the 16th century to Boole and Frege (of course, with the exception of Leibniz). Thus, old sound logical theories should be considered as anticipations of the ideas advanced in the 19th and the 20th centuries. Guided by this assumption, Łukasiewicz showed that the Stoics invented propositional calculus, contrary to the prevailing view that the Stoics' logic was a part of Aristotle's logic. In particular, Łukasiewicz demonstrated that the Stoic logic of propositions was a system of rules, not theorems. Another of Łukasiewicz's historical discoveries consisted in the rehabilitation of medieval logic, commonly neglected as fruitless scholasticism. The historical work of Polish logicians culminated in two general histories of logic written in Łukasiewicz's spirit, namely Bocheński 1961 and Kotarbiński 1965. Mostowski 1965 is an excellent survey of the development of mathematic logic and the foundations of mathematics in 1930–1964.

Historical work inspired Polish logicians toward modern interpretations of traditional logical doctrines. The most famous is Łukasiewicz's formalization of the Aristotelian logic of categorical sentences (the syllogistic plus conversion and other rules of so-called direct inference; se Łukasiewicz 1957), completed by Słupecki. Łukasiewicz interpreted this logic as a specific theory, not as a fragment of predicate logic. Yet the logic of categorical sentences assumes propositional logic as prior. The logic of assertoric sentences (Łukasiewicz also considered its modal extension) has the following form. Let the formulas (lower-case letters are term variables) *Uab*, *Iab*, *Yab*, *Oab* stand for the sentences "every *a* is *b*," "some *a* are *b*," "no *a* is *b*" and "some *a* are not *b*." We can define *Yab* as *NIab* and *Oab* as *Nuab*. The axioms are:

(a) *Uaa*;
(b) *Iaa*;
(c) *CKUmbUamUab* (the Barbara modus);
(d) *CKUmbImaIab* (the Datisi modus);

the rules: all rules of propositional calculus, substitution for term variables, the definitional replacement according to the definitions of *Yab* and *Oab*. This machinery suffices to prove all valid modes. Aristotle also gave rules for the rejection of non-conclusive schemes. Łukasiewicz added two rejected axioms, namely:

(e) $\dashv$ *CKUcbUabIac*;
(f) $\dashv$ *CKOcbOabIac*

and the usual rejection rules (see section 2.7 above). However, this was not a complete solution, because some inconclusive forms could not be rejected. Słupecki found a rule (roughly speaking: if the implications *Cxz* and *Cyz* are rejected, then the implication *Ckxyz* is also rejectable, where the letters *x* and *y* stand for *Yab* or *Oab*, but *z* represents *Uab*, *Iab*, *Yab*, *Oab* or an implication formed from such formulas or their conjunctions) which completed the issue and made the logic of categorical sentences Ł-decidable (see section 2.11 above).

2.13. *The Philosophy of Logic and Mathematics*

There was no official philosophy of logic and mathematics at the Warsaw School of Logic. In particular, most Polish logicians treated logical studies as independent of philosophical commitments. Only Leśniewski had explicit philosophical views (nominalism, see above) which influenced the shape of their systems. This does not mean that concrete works were not influenced by philosophical ideas. Łukasiewicz's many-valued logic and Tarski's theory of truth are perhaps model cases. The former had the problem of determinism in its background and the second was strongly inspired by the Aristotelian tradition in thinking about truth. It was also the case that Polish logicians had inclinations to empiricism as a general epistemological attitude and this philosophy often resulted in sympathies to nominalism (Tarski), constructivism (Mostowski) and scepticism concerning the sharp distinction between logical and extralogical truth (Tarski). However, the technical side of logical problems influenced investigations and sometimes forced changes in philosophical standpoints. The example of Łukasiewicz is instructive once again. Although he at first thought of logic as a true or false description of reality, he later adopted a more conventionalist standpoint. This attitude allowed him to accommodate various ideas coming from rival foundational directions, that is, logicism, formalism and intuitionism. In fact, Polish logicians developed versions of the simple theory of logical types (Leśniewski, Tarski). Tarski's proposal to consider logical notions as invariant under one-one transformations of sets into themselves showed new perspectives for logicism. In general, logicians from the Warsaw School of Logic admitted all legitimate mathematical methods, classical or other, in the studying of logical systems.

3. Concluding Remarks

The significance of Polish logic can be measured on a national and international scale. Looking from the former viewpoint, due to the work of Polish (not only Warsaw) logicians, logic became one of the most prestigious sciences in Poland. It strongly influenced mathematics, philosophy and teaching at all levels of Polish education and academic research. The latter perspective is much more difficult to summarize in few words. However, even a very fast journey through world logical literature allows one to see that the Warsaw School of Logic influenced almost all kinds of logical studies. In particular, Tarski's semantic truth definition revolutionized logic as well as philosophy.

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Wojciech Buszkowski

SYNTACTIC CATEGORIES AND TYPES: AJDUKIEWICZ AND MODERN CATEGORIAL GRAMMARS[1]

ABSTRACT. This essay confronts Ajdukiewicz's approach to syntactic categories with modern categorial grammars, mainly AB-grammars (basic categorial grammars) and Lambek grammars, *i.e.* categorial grammars based on different versions of the Lambek calculus.

1. Introduction and Preliminaries

(Ajdukiewicz 1935) is the most often cited paper of Kazimierz Ajdukiewicz.[2] This paper proposes an algorithm for checking the grammatical correctness (syntactic connexion) of expressions, which is based on a reduction of indices (types) assigned to single words. Types indicate semantic categories of expressions: basic categories correspond to atomic types and functor categories to functor (functional) types. The theory of semantic categories was elaborated by S. Leśniewski within his systems of the foundations of mathematics (Leśniewski 1929). The decomposition of a (meaningful) compound expression in the functor (an incomplete expression) and its arguments can be traced back to G. Frege and the concept of a semantic category to Husserl (1900–1901).

In (Ajdukiewicz 1935) the algorithm is presented in a form appropriate for languages written in Polish notation. In fact, one of Ajdukiewicz's

[1] This article is a result of the project "The Significance of the Lvov-Warsaw School in European Culture" supported by the Foundation for Polish Science.

[2] We refer to Ajdukiewicz's papers originally published in German and Polish. The quotations, however, are based on their English translations, collected in (Ajdukiewicz 1978).

In: Anna Brożek, Alicja Chybińska, Jacek Jadacki and Jan Woleński (eds.), *Tradition of the Lvov-Warsaw School: Ideas and Continuations* (*Poznań Studies in the Philosophy of the Sciences and the Humanities*, vol. 106), pp. 35–72. Amsterdam/New York, NY: Brill | Rodopi, 2016.

goals was to extend Polish notation (introduced by J. Łukasiewicz for propositional logics) to richer languages.

Ajdukiewicz's approach is seen nowadays as an anticipation of categorial grammars (type grammars); *i.e.* formal grammars based on type theories. Types were earlier used by the fathers of modern logic, implicitly by Frege and explicitly by B. Russell. Russell's types are *relational* (*i.e.* types of relations), whereas Ajdukiewicz's types are *functional* (*i.e.* types of functions).

Ajdukiewicz's type reduction procedure can be treated as a parsing algorithm which checks whether an arbitrary string of symbols (words) is well-formed (syntactically connected) according to the rules of type-theoretic syntax. Ajdukiewicz emphasizes the universality of the method: it can be applied to arbitrary languages, not only to particular logical formalisms. He writes:

> We shall base our work here on the relevant results of Leśniewski, adding on our part a symbolism, in principle applicable to almost all languages, which makes it possible to formally define and examine the syntactic connexion of a word pattern.

The term 'semantical category' was used in (Ajdukiewicz 1935) (after Husserl and Leśniewski) in a sense better expressed by 'syntactic category,' since the categories were defined with no explicit reference to semantics. In (Ajdukiewicz 1960) Ajdukiewicz comments:

> The concept of semantical categories must be clearly distinguished from the concept of syntactical categories. The term 'semantical category' was introduced for the first time by Husserl; however, the concept he associated with it would correspond better to the term 'syntactical category.' For Husserl pointed out that the expressions of a language may be classified according to the role they can play within a sentence. He defined, therefore, his categories from the syntactical viewpoint.

The notion of a syntactic category is the central notion discussed in the present paper. Some authors use the term 'category' in the sense of our 'type,' but we prefer to discriminate between them: a category is a set of expressions, and a type is a formal expression (formula). In type logics, *i.e.* formal logics underlying type grammars, types play the role of formulae.

Now we will briefly recall the main ideas and notions of the theory of formal grammars, especially categorial grammars.

Ajdukiewicz's types are either atomic types, *i.e. s* (sentence), *n* (name), or functor types, *i.e.* fractions $\frac{\alpha}{\beta_1 \ldots \beta_n}$; the denominator shows the types of arguments of the functor (an incomplete expression), and the numerator shows the type of the complex expression formed out of the functor and the arguments. They are intended to denote the basic categories and the functor categories, respectively. In propositional logic every well-formed propositional formula is of type s, the negation connective of type $\frac{s}{s}$, and

each binary connective of type $\frac{s}{ss}$. In first-order logic, every formula is of type *s*, every term of type *n*, every unary predicate symbol of type $\frac{s}{n}$, every binary predicate symbol of type $\frac{s}{nn}$, every unary function symbol of type $\frac{n}{n}$, quantifiers ∀, ∃ of type $\frac{s}{ns}$ (in languages without individual constants and function symbols), and so on. In English, proper nouns are of type *n*, verb phrases of type $\frac{s}{n}$, and transitive verb phrases of type $\frac{s}{nn}$. For the phrase 'John likes Mary,' one assigns *n* to 'John' and 'Mary' and $\frac{s}{nn}$ to 'likes.' In Polish notation, the functor 'likes' precedes the arguments, and the phrase is rewritten as 'likes John Mary.' The corresponding sequence of types $\frac{s}{nn}$, *n*, *n* reduces to *s* by applying (an instance of) the reduction rule

(RED) $\frac{\alpha}{\beta_1...\beta_n},\beta_1,...,\beta_n \Rightarrow \alpha$.

The Ajdukiewicz algorithm recognizes 'John likes Mary' as a well-formed sentence. In general, the reduction procedure may involve several applications of this reduction rule. An expression (*i.e.* a sequence of words) is *syntactically connected*, if the corresponding sequence of types reduces to a single type.

It might be said that this reduction procedure was, historically, the first parsing algorithm, an important method in mathematical linguistics. It is noteworthy that mathematical linguistics, originated by Noam Chomsky in 1956 (21 years after the publication of Ajdukiewicz 1935) as a formal theory of natural language, was extensively developed in computer science for applications in programming languages. Parsing algorithms play a key role in both disciplines.

Bar-Hillel (1953) modified this method towards a direct parsing of expressions which are not written in prefix notation. The functor types are of the form $\frac{\alpha}{\beta_1...\beta_m;\gamma_1...\gamma_n}$; here β_1, ..., β_n correspond to the left and γ_1, ..., γ_n to the right arguments of the functor. The reduction rule takes the form:

(RED') $\beta_1,...,\beta_m,\frac{\alpha}{\beta_1...\beta_m;\gamma_1...\gamma_n},\gamma_1,...,\gamma_n \Rightarrow \alpha$.

For instance, 'likes' is assigned type $\frac{s}{n;n}$, hence 'John likes Mary' yields the sequence *n*, $\frac{s}{n;n}$, *n*, which reduces to *s* by a single application of (RED').

Bar-Hillel, Gaifman and Shamir (1960) formulated the first precise definition of a categorial grammar; these categorial grammars are presently called basic categorial grammars or *AB-grammars* (a credit to Ajdukiewicz and Bar-Hillel). Types are either atomic, or functional, the latter being restricted to one-argument types $\alpha\backslash\beta$ (the argument of type α stands to the left of the functor) and β/α (the argument of type α stands to the right of the functor). The reduction rules are as follows:

(RED\) $\alpha, \alpha\backslash\beta \Rightarrow \alpha$,
(RED/) $\beta /\alpha, \alpha \Rightarrow \beta$.

An AB-grammar is formally defined as a triple $G = (\Sigma_G, I_G, s_G)$ such that Σ_G is a nonempty finite set, I_G is a map which assigns a finite set of types to each element of Σ_G, and s_G is a designated atomic type. Σ_G, I_G and s_G are called the lexicon (or: alphabet), the initial (lexical) type assignment and the designated type, respectively, of G. In examples we write $a{:}\alpha$ for $\alpha \in I_G(a)$. The elements of Σ_G are interpreted as words (lexical units) of a natural language; for a formal language, they are symbols of that language.

Let us note that Bar-Hillel *et al*. (1953) refers to Lambek (1958) who introduced the slash notation for types and essentially extended the reduction procedure; see below.

The definition of an AB-grammar, given above, has been commonly adopted in the literature (sometimes with minor changes, *e.g.* s_G need not be atomic). The same definition is applicable for type grammars based on richer type logics. Let us briefly comment on some aspects of the definition.

Ajdukiewicz's two atomic types, s (sentence) and n (name), are replaced by an arbitrary, finite set of atomic types. This fully agrees with Ajdukiewicz's views. He writes in (Ajdukiewicz 1935):

> If the concept of syntactic connexion were to be defined in strict generality, nothing could be decided about the number and kind of basic semantic and functor categories, since these may vary in different languages. For the sake of simplicity, however, we shall restrict ourselves (like Leśniewski) to languages having only two basic semantic categories, that of sentences and that of names.

Lambek (2008) presents a type grammar for English, applying 33 atomic types, *e.g.* π (subject), π_k for $k = 1, 2, 3$ (k-th person subject), $\mathbf{s}$ (statement), $\mathbf{s}_1$ (statement in present tense), $\mathbf{s}_2$ (statement in past tense), $\mathbf{n}$ (name), $\mathbf{n}_0$ (mass noun), $\mathbf{n}_1$ (count noun), $\mathbf{n}_2$ (plural noun), $\overline{\mathbf{n}}$ (complete noun phrase), $\overline{\mathbf{n}}_k$ (k-th person complete noun phrase), and others.

The map I_G is allowed to assign finitely many types to one word. This reflects the syntactic and semantic ambiguity of many words in natural languages. For instance, 'can' is used as a noun and a modal verb. Such homonyms can be eliminated by introducing different words, say, can_1, can_2, like in lexicons. This solution, however, seems problematic for other ambiguities, where a word can play different syntactic and semantic roles, preserving (essentially) the same meaning. For instance, (1) 'and' is a sentence conjunction in 'Mary sings and Mary dances' and a verb conjunction in 'Mary sings and dances,' (2) an adverb can act on intransitive verbs and transitive verbs, (3) adjectives and determiners ('some,' 'no,' 'the') can act on singular nouns and plural nouns, and so on. Even formal languages of logic often require more than one type of one symbol. The type of quantifiers $(s/s)/n$ (*i.e.* the one-argument counterpart of $\frac{s}{ns}$) does not work for languages with function symbols, since the first argument of a quantifier

must be a variable, not a compound term. We need different atomic types for variables (n) and compound terms (n'); quantifiers are typed $(s/s)/n$, but each unary function symbol has two types: n'/n and n'/n'.

Formal languages of logic usually contain infinitely many symbols, *e.g.* infinitely many variables. The corresponding AB-grammar has an infinite alphabet. For such grammars, the infinite alphabet Σ_G can be partitioned in finitely many disjoint sets Σ_i such that each symbol from Σ_i is assigned the same finite set of types. This generalization has no essential impact on our further considerations, and we adopt it, while discussing languages of logic. For natural languages and formal languages of mathematical linguistics we assume the finiteness of Σ_G.

Finite sequences of elements of Σ are called *strings* on Σ. Σ^* (resp. Σ^+) denotes the set of all (resp. nonempty) strings on Σ. By ϵ we denote the empty string. By *a language* on Σ we mean an arbitrary set $L \subseteq \Sigma^*$. A language L is said to be ϵ-free, if $\epsilon \notin L$.

Let G be an AB-grammar. One says that G assigns type α to a string $a_1 \ldots a_n$, where $n > 0$ and each a_i belongs to Σ_G, if for any $i = 1, \ldots, n$ there exists $\alpha_i \in I_G(a_i)$ such that the sequence $(\alpha_1, \ldots, \alpha_n)$ reduces to α by a number of applications of (RED\), (RED/); we write: $a_1 \ldots a_n :_G \alpha$. $L(G, \alpha)$ denotes the set of all $u \in \Sigma_G^+$ such that $u :_G \alpha$. The set $L(G, s_G)$ is called the language of G (or: generated by G) and denoted by $L(G)$.

Two grammars are said to be (weakly) equivalent if they generate the same language; two classes of grammars are equivalent if they generate the same class of languages (these notions can be applied for grammars of different kinds provided that $L(G)$ is defined for them). The main mathematical theorem of (Bar-Hillel *et al*. 1950) states *the equivalence of AB-grammars and ϵ-free context-free grammars*. Let us explain the second notion.

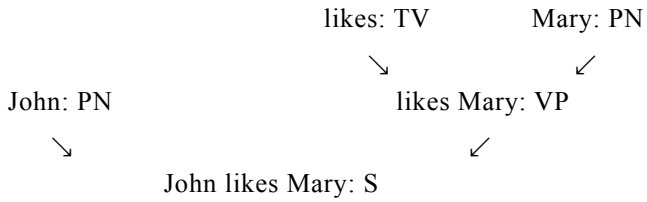

Figure 1: A parse tree in a context-free grammar

Context-free grammars (CFGs) form one of the four classes of the Chomsky hierarchy of formal grammars (the others are regular grammars, context-sensitive grammars and general production grammars). A CFG G consists of a terminal alphabet Σ_G, a nonterminal alphabet V_G, an initial

symbol $S_G \in V_G$, and a set of production rules $P_G \subset V_G \times (\Sigma_G \cup V_G)^*$; the sets Σ_G, V_G, P_G are finite and $\Sigma_G \cap V_G = \emptyset$. A production rule (A, u) is written $A \mapsto u$ and interpreted as a rewriting rule: rewrite A as u. The language of G, denoted by $L(G)$, is defined as the set of all strings on Σ_G which can be derived from S_G by a finite number of applications of production rules from P_G.

A production rule of the form $A \mapsto \epsilon$ is called a nullary rule. A CFG G is said to be ϵ-free, if P_G contains no nullary rule (then, $L(G)$ is certainly ϵ-free). A language is said to be context-free, if it is generated by a CFG. Every ϵ-free context-free language is generated by some ϵ-free CFG.

Every ϵ-free CFG can be transformed into an equivalent CFG in some normal form. The basic normal form admits only production rules $A \mapsto B_1 \ldots B_n$, $(n > 0)$, or $A \mapsto a$ (the lexical rules); hereafter the upper-case letters represent nonterminal symbols and the lower-case letters represent terminal symbols. The Chomsky normal form is the basic normal form such that $n = 2$ in each non-lexical rule. The Greibach normal form (precisely: 2-normal form) admits only rules of the form $A \mapsto a$, $A \mapsto aB$, and $A \mapsto aBC$.

In a CFG the derivation of a string x from a nonterminal A can be written in a linear form $A \Rightarrow x_1 \Rightarrow \cdots \Rightarrow x_n$, where $n \geq 0$, $x_n = x$, and each $\Rightarrow$ represents one application of a production rule. For instance, with the rules S $\mapsto$ PN VP, VP $\mapsto$ TV PN, TV $\mapsto$ 'likes,' PN $\mapsto$ 'John,' PN $\mapsto$ 'Mary' one derives: S $\Rightarrow$ PN VP $\Rightarrow$ PN TV PN $\Rightarrow$ 'John' TV PN $\Rightarrow$ 'John likes' PN $\Rightarrow$ 'John likes Mary.' (Here PN, VP and TV are nonterminals representing proper noun, verb phrase and transitive verb)

The derivation tree corresponding to this linear derivation is depicted in Figure 1. More precisely, this is a parse tree; the derivation tree omits the terminal strings in the internal nodes. This tree determines a unique *phrase structure* (John (likes Mary)), *i.e.* a decomposition of the string of words in constituents, corresponding to subtrees of the tree. One defines *the ps-language* of G as the set $L^P(G)$ which consists of all phrase structures determined by derivation trees of strings from $L(G)$. The full parse tree can be encoded by adding nonterminals to the phrase structure: here $(\text{John}_{PN}\,(\text{likes}_{TV}\,\text{Mary}_{PN})_{VP})_S$.

Every AB-grammar G can easily be transformed into an equivalent CFG G' in Chomsky normal form. We define: $\Sigma_{G'} = \Sigma_G$, $V_{G'}$ consists of all subtypes of the types appearing in G, $S_{G'} = s_G$, and $P_{G'}$ consists of all rules $\beta \mapsto \alpha(\alpha\backslash\beta)$, for $\alpha\backslash\beta \in V_{G'}$, $\beta \mapsto (\beta/\alpha)\,\alpha$, for $\beta/\alpha \in V_{G'}$, and all lexical rules $\alpha \mapsto a$, for $\alpha \in I_G(a)$. Consequently, every AB-grammar generates some ϵ-free context-free language. The converse direction of the equivalence theorem (every ϵ-free context-free language is generated by some AB-grammar) is nontrivial. It is equivalent to the Greibach normal form theorem for CFGs:

every ϵ-free CFG is equivalent to some CFG in Greibach normal form. The latter theorem has independently been proved by S. Greibach in (1965).

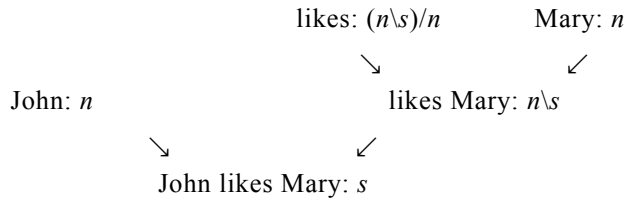

Figure 2: A parse tree in an AB-grammar.

The parse tree of 'John likes Mary' in an AB-grammar is shown in Figure 2. As above, the tree determines the phrase structure (John (likes Mary)). For AB-grammars, however, it is natural to distinguish in every compound substructure the functor and the argument, which yields a *functor-argument structure* (fa-structure). The fa-structure for this example is (John (likes Mary)$_1$)$_2$; this means that (likes Mary) is the functor in (John (likes Mary)), and 'likes' is the functor in (likes Mary).

In general, a compound fa-structure is of the form $(X_1X_2)_i$, where $i = 1$ or $i = 2$ indicates X_i as the functor, and a compound phrase structure is of the form (X_1X_2). The precise definition is recursive: (i) all elements of Σ are fa-structures on Σ, (ii) if X, Y are fa-structures on Σ, then $(XY)_1$ and $(XY)_2$ are fa-structures on Σ. One can represent fa-structures and phrase structures as trees; see Figure 3.

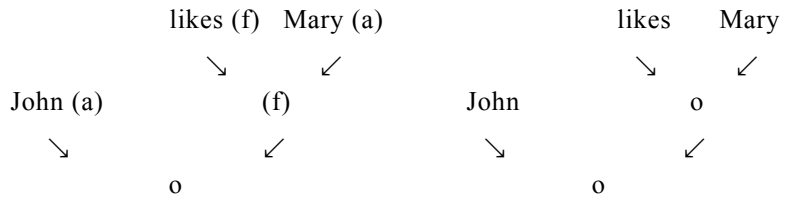

Figure 3: (John (likes Mary)$_1$)$_2$ and (John (likes Mary)) depicted as trees.

Here we confine ourselves to one-argument types, but it is not very essential. Many-argument types of the form, say, $\beta_1 \ldots \beta_m\backslash\alpha/\gamma_1 \ldots \gamma_n$ (a flattened version of Bar-Hillel's fractions) might be admitted as well, and the corresponding fa-structures would be of the form $(X_1 \ldots X_k)_i$, where $1 \leq i \leq k$; this means that X_i is the functor, X_1, ..., X_{i-1} are the left arguments, and X_{i+1}, ..., X_k

are the right arguments. This approach seems even more natural in many situations. For instance, sentential connectives 'and,' 'or' can be assigned type $s\backslash s/s$, whereas the one-argument format enforces $(s\backslash s)/s$ and/or $s\backslash(s/s)$, both artificial. Categorial grammars with many-argument types were considered in (Buszkowski 1986a, 1987 and 1989). In fact, these papers admit more general structures and types, which indicate a syntactic operation acting on the surface level; besides concatenation one may regard other operations, *e.g.* substitution is useful for discontinuous expressions.

The representation of expressions as fa-structures quite naturally reflects the fundamental idea of categorial grammars: each compound expression can be constructed by application of a functor to its argument(s). The particular form of fa-structures, admitted here, may look strange even for logicians. In formal languages of logic, functors are usually simple symbols, and their role is determined by their meaning, *e.g.* connectives, function symbols, relation symbols *etc*. are functors, and variables, individual constants, *etc*. are not functors. A standard tree representation of the propositional formula *NCpq* has the root *N*, its daughter *C*, and *p* and *q* as the daughters of *C*. This representation, however, is inappropriate for languages with compound functors, and natural languages belong to this class; *e.g.* (likes Mary) can be treated as the compound functor in (John (likes Mary)), (no student) as the compound functor in ((no student) came), and so on. Our notation for fa-structures seems clear and economical; other authors use some variants of it, *e.g.* Kanazawa (1996) writes FA(X, Y) (forward application) for our $(XY)_1$ and BA(X, Y) (backward application) for our $(XY)_2$.

Y. Bar-Hillel argued that AB-grammars are an 'analytic' counterpart of CFGs; while the latter generate the terminal string of words from the initial symbol, the former start from a string of words and reduce the corresponding sequence of types to the designated type. Currently this difference seems less important; parsing algorithms for both kinds of grammars can be designed in the bottom-up style and the top-down style; see (Hopcroft and Ullman 1979). The most characteristic feature distinguishing categorial grammars from production grammars is *lexicality*: the grammatical information on the particular language is totally encoded in the lexical type-assignment, and the processing of compound expressions is based on some universal rules, independent of the particular language (*e.g.* (RED\), (RED/)). This is not the case for production grammars. Typical context-free production rules are of the form $A \mapsto B_1 \ldots B_n$, *e.g.* $S \mapsto$ NP VP (a sentence consists of a noun phrase and a verb phrase). A lexicalization of CFGs can be done through their reduction to the Greibach normal form; the production rule $A \mapsto aB_1 \ldots B_n$ provides information on the syntactic role of a, which can be expressed by $a : (\ldots((A/B_n)/B_{n-1})/\cdots)/B_1$ in an

AB-grammar. AB-grammars may be regarded as a lexical counterpart of CFGs, more refined and logically oriented than the Greibach normal form.

The reduction procedure based on (RED\), (RED/) can be replaced by a richer type logic. The seminal paper in this direction is Lambek (Lambek 1958) (1958), introducing Syntactic Calculus, nowadays called Lambek Calculus and denoted by L. It is usually presented as a sequent system; *sequents* are formal expressions of the form $\alpha_1, ..., \alpha_n \Rightarrow \alpha$, whose intended meaning is: if $u_1, ..., u_n$ are strings of type $\alpha_1, ..., \alpha_n$, respectively, then the concatenation $u_1 \cdots u_n$ is of type α. In L, types are formed out of atomic types (variables) by means of three operators (connectives): $\cdot$ (product, fusion, multiplicative conjunction), \ (right multiplicative implication), and / (left multiplicative implication). Some authors write $\rightarrow$ for \ and $\leftarrow$ for /. Besides the laws equal to (RED\), (RED/), there are many other laws provable in L, for instance: $\alpha\backslash\beta, \beta\backslash\gamma \Rightarrow \alpha\backslash\gamma$ and $\alpha/\beta, \beta/\gamma \Rightarrow \alpha/\gamma$ (composition laws), $\alpha \Rightarrow (\beta/\alpha)\backslash\beta$ and $\alpha \Rightarrow \beta/(\alpha\backslash\beta)$ (type-raising laws), $\alpha \Rightarrow \beta\backslash(\beta \cdot \alpha)$ and $\alpha \Rightarrow (\alpha \cdot \beta)/\beta$ (expansion laws).

Many extensions and variants of L play the role of type logics in the modern literature on categorial grammars. In the logical community these logics are called *substructural logics*; their sequent systems lack some structural rules, appearing in Gentzen-style sequent systems for intuitionistic and classical logic (exchange, contraction, left and right weakening). Given a type logic $\mathscr{L}$, the categorial grammars based on $\mathscr{L}$ are referred to as $\mathscr{L}$-grammars. They are defined like AB-grammars except that one may admit a larger set of types and the provability in $\mathscr{L}$ replaces the former reduction procedure. In fact, this procedure is equivalent to a subsystem of L, denoted by AB. (So AB-grammars are the type grammars based on AB.)

Substructural logics enjoy a still growing attention of contemporary logicians, since they seem to play a fundamental role in the family of nonclassical logics. From the algebraic point of view, they are logics of residuation: implication(s) is (are) treated as residual operation(s) for product. Many important nonclassical logics, *e.g.* Łukasiewicz's many-valued logics, Hajek's fuzzy logics, some relevant logics, intuitionistic logic, linear logics, can be presented as axiomatic extensions of Full Lambek Calculus (FL), *i.e.* Lambek Calculus with lattice connectives $\wedge$, $\vee$ and constants 1, 0. Type logics of categorial grammars are usually restricted to the basic logics of this family: AB, L, FL and their variants.

In the present paper we cannot present many highly interesting aspects of type logics, such as their algebras, different proof systems, relations to other nonclassical logics, complexity, and others. The reader is referred to (Galatos, Jipsen, Kowalski and Ono 2007) (a recent monograph on substructural logics), and the author's survey papers (Buszkowski 1997, 2010); also see Moortgat (1997, 2012).

Another characteristic feature of categorial grammars is their close relation to type-theoretic semantics. The semantical interpretation of Ajdukiewicz's approach was proposed by (Bocheński 1949), and Ajdukiewicz adopted it in (Ajdukiewicz 1960). The reduction procedure of AB-grammars can be reflected in semantics as the computation of meanings (denotations) by function application as the only computation rule; richer type logics involve lambda abstraction. The Curry-Howard isomorphism provides a correspondence between logical proofs in the natural deduction format and logical forms of expressions, usually represented by typed lambda-terms, which determine the denotations of these expressions, if interpreted in a particular model.

In this short paper we cannot thoroughly discuss type-theoretic semantics, which is today a large, advanced discipline, developed in different directions. We focus on syntax and only briefly outline some interrelations with semantics. For more information on type-theoretic semantics the reader is referred to (Montague 1974) and further developments in *e.g.* (Keenan and Faltz 1985), (van Benthem 1986) and (Partee, ter Meulen and Wall 1990).

The further contents are divided into two sections. In Section 2 we consider AB-grammars: the relation of typed categories to categories as substitution classes, some basic properties of structure languages generated by these grammars, and others. Section 3 is concerned with syntactic categories in Lambek categorial grammars; we emphasize essential differences in comparison with the AB-framework. Although we focus on basic philosophical ideas, we employ some mathematical notions, needed for explication of these ideas. For AB-grammars, these are mainly free algebras of fa-structures and some congruences in them. Lambek grammars require some elements of proof theory and residuated algebras. All linguistic examples are simple; they merely illustrate general principles. Fine linguistic applications are provided in (Morrill 1994), (Moot and Retore 2012) and (Lambek 2008).

This essay often refers to earlier publications of the author and others. Especially the author's book (Buszkowski 1989), in Polish, extensively discussed the foundations of AB-grammars and L-grammars. A formal reconstruction of Ajdukiewicz's ideas can be found in the book (Wybraniec-Skardowska 1991). Our approach is more general (Wybraniec-Skardowska 1991 is confined to one-valued grammars for languages in prefix notation) and regards more concepts, central for the subject-matter; on the other hand, we do not take into account the distinction between expressions (types) as tokens and expressions (types) as types, elaborated in (Wybraniec-Skardowska 1991). A recent philosophical discussion of the basic properties of categorial grammars, mainly AB-grammars, can be

found in (Tałasiewicz 2010). In this paper we briefly recall some earlier results (without proofs), but our main concerns are different: we confront Ajdukiewicz's approach to syntactic categories with later developments and try to point out main similarities and differences.

Type-theoretic syntax and semantics were studied by many other authors (in Poland, by R. Suszko 1958, A. Nowaczyk 1978, and others). These works were primarily concerned with formal languages; especially the construction of higher-order logical languages and their models. Here we focus on categorial grammars appropriate for the description of natural languages.

Not all problems posed by Ajdukiewicz in (1934) and (1935) are touched on here. For example, we do not discuss the distinction between functors and (variable binding) operators, though we apply Ajdukiewicz's types with | in a different context.

2. Syntactic Categories in AB-Grammars

One of the basic intuitions of the theory syntactic categories is *the principle of substitution*: two expressions belong to the same category, if they can be substituted for each other in sentential contexts. This principle, admitted by Ajdukiewicz after Husserl (who wrote 'meaningful' for 'sentential') and Leśniewski, can be explicated in different ways.

In (1934), Ajdukiewicz writes:

> Expressions A and B, taken in sense a and b respectively, belong to the same semantical category if and only if every sentence Z_A containing expression A in sense a upon replacement of A by B taken in sense b (the meaning of all other expressions and their interconnections remaining unaltered) is transformed into an expression which is also a sentence, and if vice versa: every sentence Z_B upon replacement of B by A (with analogous qualifications) is also transformed into a sentence.

A similar, but not identical formulation appears in (Ajdukiewicz 1935).

> The word or expression A, taken in sense x, and the word or expression B, taken in sense y, belong to the same semantic category if and only if there is a sentence (or sentential function) S_A, in which A occurs with meaning x, and which has the property that if S_A is transformed into S_B upon replacing A by B (with meaning y), then S_B is also a sentence (or sentential function). (It is understood that in this process the other words and the structure of S_A remain the same.)

Our further discussion will focus on these two versions of the principle of substitution. The striking difference between them is the universal quantification 'every sentence Z_A' in the former and the existential quantification 'there is a sentence' in the latter. Furthermore, it is not obvious that the equivalence classes of the relation defined as in the first version coincide

with the typed categories, corresponding to different types. We show that both formulations are compatible with the theory of AB-grammars, if interpreted in a proper way.

In both versions A and B belong to the same category if and only if they are mutually substitutable in sentences (sentential functions). It follows that the categories are determined by some set L of sentences; for languages of logic, sentences should be replaced by formulae (*i.e.* propositional functions).

Both versions assume that the replacement of A by B preserves the sentence structure (in the first version: the interconnections of all other expressions). It follows that sentences are treated as structured expressions, for instance, phrase structures or fa-structures rather than strings of words. Let us discuss the matter more formally.

In mathematical linguistics, for a language $L \subseteq \Sigma^*$ one defines *the syntactic congruence* determined by L as follows:

$$u \equiv_L v \Leftrightarrow \forall w_1, w_2 \in \Sigma^* \ (w_1 u w_2 \in \mathrm{L} \Leftrightarrow w_1 v w_2 \in L),$$

for $u, v \in \Sigma^*$. The relation $\equiv_L$ is a congruence in the free monoid Σ^* (the monoid operation is concatenation, and ϵ is the unit); furthermore, $\equiv_L$ is the largest congruence in Σ^* *compatible* with L (this means: L is the union of some family of equivalence classes). Clearly $u \equiv_L v$ explicates the idea of mutual substitutability of u and v in the strings from L.

By the index of an equivalence relation $\equiv$ one means the cardinality of the family of the equivalence classes of $\equiv$. It is well known that $\equiv_L$ is of finite index if and only if L is a regular language (*i.e.* accepted by a finite-state automaton); see Hopcroft and Ullman (1979). The regular languages are a poor family of formal languages. The standard languages of logic are not regular. For instance, the language LPL of propositional logic in Polish notation is not regular; the strings C, CC, CCC *etc*. belong to different equivalence classes of $\equiv_{L(PL)}$ since *e.g.* $Cpp \in L_{PL}$, $CCpp \notin L_{PL}$. On the other hand, one can distinguish only three natural syntactic categories in L_{PL}: well-formed formulae, negation, binary connectives (one can add the fourth category: not well-formed expressions). Consequently even for simple formal languages L, syntactic categories cannot be defined as the equivalence classes of $\equiv_L$.

Following Ajdukiewicz's suggestion, we consider analogous relations on the level of structures. By Σ^F (resp. Σ^P) we denote the set of all fa-structures (resp. phrase structures) on Σ. Any set $L \subseteq \Sigma^F$ (resp. $L \subseteq \Sigma^P$) is called a fa-language (resp. a ps-language). *Contexts* are structures containing one occurrence of a special atom _ (a place for substitution). If X is a context, then $X[Y]$ denotes the substitution of Y for _ in X. $\Sigma^{F[]}$ (resp. $\Sigma^{P[]}$) denotes the set of all fa-contexts (resp. ps-contexts) on Σ.

Let $L \subseteq \Sigma^F$. The relation $\equiv_L$ on Σ^F is defined as follows:

$$X \equiv_L Y \Leftrightarrow (\forall Z \in \Sigma^{F[]})(Z[X] \in L \Leftrightarrow Z[Y] \in L),$$

for $X, Y \in \Sigma^F$. (For $L \subseteq \Sigma^P$, the relation $\equiv_L$ on Σ^P is defined in a similar way.) $\equiv_L$ is a congruence in the free algebra Σ^F (the operations are $(\ , \ )_1$ and $(\ , \ )_2$); furthermore, $\equiv_L$ is the largest congruence in Σ^F compatible with L. The analogous facts hold for the ps-version. The equivalence classes of $\equiv_L$ are called *the substitution classes* of the fa-language L, and similarly for ps-languages.

It is known that that the ps-languages of CFGs are precisely the ps-languages L such that $\equiv_L$ is of finite index (*i.e.* the regular ps-languages). WARNING: for unrestricted CFGs, one must admit phrase structures of the form $(X_1 \ldots X_n)$, for $n \geq 1$; our 'binary' phrase structures are appropriate for CFGs in Chomsky normal form.

For AB-grammars the most natural representations of expressions are fa-structures. They are uniquely determined by proofs in AB, presented as a natural deduction system (ND-system).

The axioms are:

(Id) $\quad \alpha \Rightarrow \alpha$

and the inference rules are the elimination rules for \, /:

(E\) $\quad \dfrac{\Gamma \Rightarrow \alpha; \Delta \rightarrow \alpha \setminus \beta}{\Gamma, \Delta \Rightarrow \beta}$,

(E/) $\quad \dfrac{\Gamma \Rightarrow \beta / \alpha; \Delta \Rightarrow \alpha}{\Gamma, \Delta \Rightarrow \beta}$.

Here Γ and Δ stand for finite sequences of formulae and 'Γ, Δ' denotes the concatenation of Γ and Δ. (This notation is commonly used in sequent systems.)

Proofs in this system, presented as proof trees, determine fa-structures on the antecedents of sequents. These are fa-structures on the set of formulae (types); we call them formula structures. They can be made explicit, if one replaces the conclusion of (E\) by $(\Gamma, \Delta)_2 \Rightarrow \beta$ and the conclusion of (E/) by $(\Gamma, \Delta)_1 \Rightarrow \beta$. WARNING: here Γ and Δ stand for formula structures, and $(\Gamma, \Delta)_i$ is a compound formula structure whose constituents are Γ and Δ (in formula structures we separate the constituents by a comma, just for better readability).

Let G be an AB-grammar. The map I_G is extended for all $X \in \Sigma_G^F$ by setting:

$$I_G((XY)_i) = \{(\Gamma, \Delta)_i : \Gamma \in I_G(X), \Delta \in I_G(Y)\}.$$

We say that G assigns type α to $X \in \Sigma_G^F$ (write: $X :_G \alpha$), if there is $\Gamma \in I_G(X)$ such that $\Gamma \Rightarrow \alpha$ is provable in AB. This definition is compatible

with the procedure of determining fa-structures from parse trees, described in Section 1.

We define $T_G^F(X) = \{\alpha : X :_G \alpha\}$, $L^F(G, \alpha) = \{X \in \Sigma_G^F : \alpha \in T_G^F(X)\}$. We also define $\mathscr{T}(G) = \cup\{I_G(a) : a \in \Sigma_G\} \cup \{s_G\}$ and $s(\mathscr{T}(G))$ as the set of all subformulae of the formulae (types) from $\mathscr{T}(G)$.

Since the conclusions of (E\) and (E/) consist of subformulae of the formulae occurring in the premises, then $T_G^F(X) \subseteq s(\mathscr{T}(G))$ for any $X \in \Sigma_G^F$.

The fa-language $L^F(G, s_G)$ is called the fa-language generated by G and denoted by $L^F(G)$. By dropping all functor markers in the structures from $L^F(G)$ one obtains the ps-language of G, denoted by $L^P(G)$, and $L(G)$ is obtained by dropping all structure markers. The set $L^F(G, \alpha)$ can be referred to as *the category of type* α in G; see the discussion below.

EXAMPLE 1. Consider the following AB-grammar G. The lexicon consists of four words: 'Mary,' 'is,' 'very,' 'apt.' I_G is defined by: 'Mary': n, 'is': $(n\backslash s)/a$, 'very': a/a, 'apt': a (so a is the type of adjectives). The designated type is s. This grammar generates an infinite fa-language, whose first elements are:

$$(\text{Mary } (\text{is apt})_1)_2$$
$$(\text{Mary } (\text{is } (\text{very apt})_1)_1)_2$$
$$(\text{Mary } (\text{is } (\text{very } (\text{very apt})_1)_1)_1)_2$$

The ps-language of G contains the phrase structures (Mary (is apt)), (Mary (is (very apt))) and so on, and the language of G the strings 'Mary is apt,' 'Mary is very apt' and so on. $L^F(G, a)$ contains the fa-structures 'apt,' $(\text{very apt})_1$, $(\text{very } (\text{very apt})_1)_1$ and so on.

We need some notions which intuitively appeal to the tree representation of fa-structures and phrase structures; see Section 1. We only consider paths going upwards. An f-path is a path for which all nodes, possibly except the first one, are marked by (f). The f-degree of $L \subseteq \Sigma^F$, denoted $d_f(L)$, is the maximal length of f-paths in structures from L, if it exists; we set $d_f(\emptyset) = 0$, and $d_f(L) = \infty$, if the lengths of f-paths are unbounded in L. The following notions are meaningful for fa-structures, phrase structures and the corresponding languages. The outer degree of a structure X is the length of the shortest path in X from the root to a leaf. The degree of X, denoted $d(X)$, is the maximal outer degree of substructures of X. The degree of L, denoted $d(L)$, is the maximal $d(X)$, for $X \in L$, if it exists; we set $d(\emptyset) = 0$ and $d(L) = \infty$, if $\{d(X) : X \in L\}$ is unbounded.

EXAMPLE 2. In X depicted in Figure 3, the maximal f-path goes from the root to 'likes' and is of length 2, but $d(X) = 1$, since the distance of each node to the closest leaf is at most 1. The f-degree of the fa-language from Example 1 equals 2, but its degree equals 1. $d_f(\Sigma^F) = \infty$, $d(\Sigma^F) = \infty$, $d(\Sigma^P) = \infty$.

The fa-languages of AB-grammars can be characterized as *the fa-languages L such that* $\equiv_L$ *is of finite index and* $d_f(L)$ *is finite*. This result has been proved in Buszkowski (1986a).

We outline the proof in one direction, since it employs some relevant notions. For an AB-grammar G, the relation $\equiv_G^F$ on Σ_G^F is defined as follows:

$$X \equiv_G^F Y \Leftrightarrow T_G^F(X) = T_G^F(Y),$$

for $X, Y \in \Sigma_G^F$. If U, V are sets of types, one defines:

$$U \rhd V = \{\beta : \exists_\alpha(\alpha \in U \wedge (\alpha\backslash\beta) \in V)\},$$
$$U \lhd V = \{\beta : \exists_\alpha((\beta/\alpha) \in U \wedge \alpha \in V)\}.$$

It is easy to show:

$$T_G^F((XY)_1) = T_G^F(X) \lhd T_G^F(Y),\ T_G^F((XY)_2) = T_G^F(X) \rhd T_G^F(Y),$$

for all $X, Y \in \Sigma_G^F$. Consequently $X \equiv_G^F X'$ and $Y \equiv_G^F Y'$ entail $(XY)_i \equiv_G^F (X'Y')_i$, which means that $\equiv_G^F$ is a congruence in Σ_G^F. It is compatible with $L^F(G)$, since $X \in L^F(G)$ if and only if $s_G \in T_G^F(X)$. The index of $\equiv_G^F$ is finite (at most 2^m, where m is the cardinality of $s(\mathcal{I}(G))$). Since $\equiv_G^F \subseteq \equiv_{L^F(G)}$ (the former is a congruence compatible with $L^F(G)$, and the latter is the largest congruence compatible with $L^F(G)$), then every equivalence class of $\equiv_{L^F(G)}$ is the union of a family of equivalence classes of $\equiv_G^F$. Consequently $\equiv_{L^F(G)}$ is of finite index.

To show that $d_f(L^F(G))$ is finite it is convenient to represent types as fa-structures on the set of variables: write $(\alpha\beta)_2$ for $\alpha\backslash\beta$ and $(\alpha\beta)_1$ for α/β. Although the new notation looks weird, it is quite helpful; *e.g.* the degree and the f-degree of a set of types can be defined as for fa-languages. It is easy to show that for any AB-grammar G, $d_f(L^F(G)) \leq d_f(\mathcal{I}(G))$, and consequently $d_f(L^F(G))$ is finite.

The ps-languages of AB-grammars can be characterized as *the ps-languages L such that* $\equiv_L$ *is of finite index and* $d(L)$ *is finite*. Σ^P is generated by the CFG with rules $S \mapsto S\,S$, $S \mapsto a$, for $a \in \Sigma$, but by no AB-grammar, since $d(\Sigma^P) = \infty$. Consequently the ps-languages of AB-grammars are a proper subclass of the ps-languages of CFGs (in Chomsky normal form). One can say that AB-grammars are not strongly equivalent (precisely: P-equivalent) to CFGs, although the (weak) equivalence holds.

We return to the main issue of this section: the relation of categories as substitution classes to typed categories. For an AB-grammar G, the former can be identified with the substitution classes of $L^F(G)$ and the latter with the sets $L^F(G, \alpha)$. Take note that for $\alpha \notin s(\mathcal{I}(G))$, $L^F(G, \alpha) = \emptyset$. Although both families are finite, they are different in general.

We have shown that the relation $\equiv^F_G$ is always finer than (or equal to) the relation $\equiv_{L^F(G)}$. An AB-grammar G is said to be *well-constructed*, if it satisfies the following conditions:

(WC.1) $\equiv_{L^F(G)} = \equiv^F_G$,
(WC.2) for any $\alpha \in s(\mathcal{T}(G))$, $L^F(G, \alpha) \neq \emptyset$.

(WC.1) requires that each substitution class of $L^F(G)$ consists of all structures which are assigned the same set of types in G. (WC.2) additionally requires that G employs no 'void' type, *i.e.* a type not assigned to any expression.

For $L \subseteq \Sigma^F$, by $s(L)$ we denote the set of all substructures of the structures from L. For any $L \subseteq \Sigma^F$, if $s(L) \neq \Sigma^F$, then $\Sigma^F - s(L)$ is a single substitution class of L. This class consists of not well-formed expressions with respect to L and is denoted by non(L) (the class of nonsense). Notice that for any AB-grammar G, $s(L^F(G)) \neq \Sigma^F_G$, since $d_f(\Sigma^F_G) = \infty$, but $d_f(s(L^F(G)))$ is finite (equals $d_f(L^F(G))$). Consequently non($L^F(G)$) is defined.

It follows from (WC.1) that X belongs to non($L^F(G)$) if and only if $T^F_G(X) = \emptyset$. The implication ($\Leftarrow$) is obvious. For ($\Rightarrow$), observe that non($L^F(G)$) must contain a structure Y such that $T^F_G(Y) = \emptyset$, since the f-degree of non($L^F(G)$) is infinite, but the union of all typed categories in G has a finite f-degree. Thus, for any X in non($L^F(G)$), we have $X \equiv_{L^F(G)} Y$, hence $X \equiv^F_G Y$, by (WC.1), which yields $T^F_G(X) = \emptyset$.

Example 3. We present some examples of grammars which are not well-constructed. G_1 assigns $s/(p/q)$ to a and p/q to b, $\Sigma_{G_1} = \{a, b\}$, $s_{G_1} = s$. Then, $L^F(G_1) = \{(ab)_1\}$, (WC.1) holds, but (WC.2) fails, since $L^F(G, q) = \emptyset$. G_2 assigns s/p and s/q to a, p to b, and q to c, $\Sigma_{G_2} = \{a, b, c\}$, $s_{G_2} = s$. Then, $L^F(G_2) = \{(ab)_1, (ac)_1\}$, (WC.2) holds, but (WC.1) fails: b and c belong to the same substitution class, but $T^F_{G_2}(b) \neq T^F_{G_2}(c)$.

These examples are artificial. If one designs an AB-grammar for a formal language or (a fragment of) a natural language, then one usually obtains a well-constructed grammar. In Buszkowski (1986a) it is proved that *every AB-grammar G is F-equivalent to a well-constructed AB-grammar* G', where the F-equivalence means: $L^F(G) = L^F(G')$ (Buszkowski (1986a) uses 'adequate' for 'well-constructed'). We skip the proof. We only note that the atomic types in G', different from $s_{G'}$, are in a one-one correspondence with the substitution classes of $L^F(G)$, different from the nonsense class, and $s_{G'}$ is assigned to the structures from $L^F(G)$.

Buszkowski (1987) provides an effective construction of G' from G. One uses the powerset algebra $\wp(s(\mathcal{T}(G)))$ with operations $\triangleright$, $\triangleleft$. The subalgebra $A(G)$ of this algebra, generated by the set $\{I_G(a) : a \in \Sigma_G\}$, is isomorphic to the quotient-algebra $\Sigma^F_G / \equiv^F_G$; the isomorphism is defined by $h([X]_{\equiv}) = T^F_G(X)$. $A(G)$ is a finite algebra, effectively constructed from G.

The elements of $A(G)$, *i.e.* certain sets of types, represent the structures from Σ_G^F up to $\equiv_G^F$.

By this method, G_1 from Example 3 is transformed into the well-constructed grammar $a : s/p$, $b : p$, and G_2 to $a : s/p$, $b : p$, $c : p$.

The well-constructed grammars attain the closest concord between the substitution classes of the generated fa-language and the typed categories of the grammar, which is possible for the general case. Since one expression can be assigned several types, typed categories may overlap, hence they do not partition the universe. Every well-constructed AB-grammar G satisfies the following.

(S-T) Every typed category $L(G, \alpha)$, for $\alpha \in s(\mathcal{T}(G))$, is the union of a nonempty family of substitution classes of $L^F(G)$ which are contained in $s(L^F(G))$. Every substitution class of $L^F(G)$, different from $\mathrm{non}(L^F(G))$, is the intersection of a nonempty family of typed categories.

We show that the perfect concordance can be reached for one-valued grammars. An AB-grammar is said to be *one-valued* (or: rigid), if $I_G(a)$ contains at most one type, for any $a \in \Sigma_G$. Less formally, a one-valued AB-grammar assigns at most one type to each word.

By $\mathcal{G}_1$ we denote the class of one-valued AB-grammars. If $G \in \mathcal{G}_1$, then every $X \in \Sigma_G^F$ is assigned at most one type. So $X \equiv_G^F Y$ if and only if X and Y are assigned either the same type, or no type in G. If X is assigned a type in G, then each substructure of X is assigned a unique type.

For $G \in \mathcal{G}_1$, the relations $\equiv_G^F$ and $\equiv_{L^F(G)}$ coincide on $s(L^F(G))$. Nonetheless, not every $G \in \mathcal{G}_1$ is well-constructed.

EXAMPLE 4. Consider G_3 with the alphabet $\{a, b, c\}$, $s_{G3} = s$, which assigns: $a : s/(p/q)$, $b : p/q$, $c : q$. Then, $L^F(G_3) = \{(ab)_1\}$, (WC.2) holds, but (WC.1) fails, since $(bc)_1$ and c belong to $\mathrm{non}(L^F(G_3))$, but $(bc)_1 : p$, $c : q$ in G_3.

$G \in \mathcal{G}_1$ is well-constructed if and only if every type from $s(\mathcal{T}(G))$ is assigned to some $X \in s(L^F(G))$ (a strengthening of (WC.2)).

Every $G \in \mathcal{G}_1$ can be (effectively) transformed into a well-constructed $G' \in \mathcal{G}_1$, F-equivalent to G. Furthermore, G' is unique up to renaming atomic types; see Buszkowski (1986a) and (1987). This construction is different from the one for arbitrary AB-grammars. One defines a relation $<_G$ on Σ_G^F: $X <_G Y$ if and only if there exists $Z \in s(L^F(G))$ such that Y is the functor of Z and either X is the argument of Z or $X \equiv_{L^F(G)} Z$ (this relation is closely related to the following relation between types: $\alpha < \alpha\backslash\beta$, $\beta < \alpha\backslash\beta$, and similarly for β/α). This relation is invariant with respect to $\equiv_{L^F(G)}$, hence it yields the quotient relation $<_G^{\equiv}$ on $\Sigma_G^F / \equiv_{L^F(G)}$, and the latter relation is well-founded (*i.e.* every nonempty set of substitution classes has a minimal element).

The type assignment of G' is defined by induction on $<^{\equiv}_{G}$. In particular, the atomic types of G' correspond to the minimal substitution classes (one of them is $L^F(G)$, and it corresponds to $s_{G'}$). Again, the construction can be done effectively, using $A(G)$.

For instance, G_3 can be transformed into G_4, assigning $a : s/p$, $b : p$, $c : \emptyset$, which is well-constructed.

For any well-constructed $G \in \mathcal{G}_1$, there holds:

(S-T$_1$) every substitution class of $L^F(G)$, different from the class of nonsense, equals some typed category $L^F(G, \alpha)$ for a unique $\alpha \in s(\mathcal{A}(G))$, and conversely, every typed category $L^F(G, \alpha)$ with $\alpha \in s(\mathcal{A}(G))$ equals some substitution class contained in $s(L^F(G))$.

Every $G \in \mathcal{G}_1$ satisfies the following conditions:

(1) if $Z[X] \in s(L^F(G))$ and $Z[X] \equiv^F_G Z[Y]$ then $X \equiv^F_G Y$,
(2) if $X \equiv^F_G Y$ then $Z[X] \equiv^F_G Z[Y]$,

for all $X, Y \in \Sigma^F_G$ and $Z \in \Sigma^{F[]}_G$. (1) and (2) express essentially the same as "the fundamental theorems of the theory of syntactic categories" in Wybraniec-Skardowska (1991). If $G \in \mathcal{G}_1$ is well-constructed, then in (1), (2) $\equiv^F_G$ can be replaced by $\equiv_{L^F(G)}$.

Consequently, for any $G \in \mathcal{G}_1$, we obtain:

(3) $$\forall_{X,Y \in s(L^F(G))}(X \equiv_{L^F(G)} Y \Leftrightarrow \exists_{X \in \Sigma^{F[]}_G}(Z[X] \in L^F(G) \wedge Z[Y] \in L_F(G))).$$

We prove ($\Rightarrow$). Assume that $X, Y \in s(L^F(G))$ and $X \equiv_{L^F(G)} Y$. Then, $Z[X] \in L^F(G)$, for some context Z. Consequently $Z[Y] \in L^F(G)$ for the same Z, which yields the right-hand side of (3). We prove ($\Leftarrow$). Let Z be a context such that $Z[X] \in L^F(G)$ and $Z[Y] \in L^F(G)$. Then, $Z[X] :_G s_G$ and $Z[Y] :_G s_G$, and consequently $Z[X] \equiv^F_G Z[Y]$. By (1), $X \equiv^F_G Y$, which yields $X \equiv_{L^F(G)} Y$.

(3) shows that the two versions of the principle of substitution are equivalent for one-valued AB-grammars (if restricted to substructures of sentences). (3) with $L \subseteq \Sigma^F$ in the place of $L^F(G)$ remains true for a wider class of fa-languages. For instance, the language of combinatory logic satisfies the equivalence, though it cannot be generated by any one-valued AB-grammar (in the combinatory term xx two types are needed for x). Tarski (1933/1956) regarded the property expressed by (3) as a characteristic feature of formal languages in mathematics and logic. Quite likely, in (1935) Ajdukiewicz formulated the principle with 'there is a sentence' instead of 'every sentence' under the influence of Tarski's view.

The second version of the principle was criticized by some authors as inadequate for natural languages. Indeed, in English and probably all natural languages one can find many examples of expressions which are substitutable in some but not all contexts, even under the requirement that the

substitution must preserve the sentence structure. For instance, in 'Mary calls John' one can replace 'John' by 'a friend,' which is impossible in 'Mary calls the old John'; in 'the teacher examines a student' one can replace 'a student' by 'two students,' which is impossible in 'a student calls the teacher.'

Ajdukiewicz was certainly aware of these problems, when he formulated the principle in (Ajdukiewicz 1935) and at the same time claimed the universality of his approach. This can be explained quite simply. His method is applicable ("in principle") to arbitrary languages provided that these languages are reconstructed in the style of formal languages. Both formulations of the principle of substitution contain the qualification: *A* in meaning (sense) *a*. This makes it possible not only to treat homonyms as different expressions (like 'can$_1$,' can$_2$' in Section 1) but also to remove all syntactic ambiguities: if a word appears in different contexts with different types, then one treats the differently typed words as different words. In this way, every AB-grammar can be transformed into a one-valued grammar: if $I_G(a) = \{\alpha_1, ..., \alpha_n\}$, then *a* is replaced by *n* copies $a(1)$, ..., $a(n)$ typed $a(i) : \alpha_i$. The resulting one-valued AB-grammar satisfies (3). If the former grammar is well-constructed, then the latter grammar is well-constructed.

As we have noted in Section 1, Ajdukiewicz wanted to extend the Łukasiewicz parenthesis-free notation (Polish notation) for richer languages. For propositional languages, considered by Łukasiewicz, there is one atomic type *s*, unary connectives are typed *s*/*s*, binary connectives *s*/*ss* (or: (*s*/*s*)/*s*), and so on. Each well-formed string of symbols has a unique type and a unique structure, and they can be effectively computed from the string if one knows the number of arguments of each connective. For richer languages, the number of arguments is not sufficient; one must know the types of all symbols. We will explain the matter in more detail.

An AB-grammar *G* is said to be *unidirectional*, if all types in $\mathcal{A}(G)$ are /-types (resp. \-types), this means, they do not contain \ (resp. /). *The yield* of an fa-structure *X* is the string obtained from *X* by dropping all structure markers; *the ps-yield* of *X* is obtained by dropping all functor markers. Unidirectional one-valued AB-grammars are *categorially* and *structurally unambiguous*: for any string $u \in \Sigma_G^+$, there is at most one pair (X, α) such that *u* is the yield of *X* and $X :_G \alpha$; see (Buszkowski 1998).

This also holds for AB-grammars with Ajdukiewicz's many-argument types $\alpha/\beta_1 ... \beta_n$. It is noteworthy that Ajdukiewicz's approach in (Ajdukiewicz 1935) needs some revision at this point. According to Ajdukiewicz, the reduction procedure can be performed in a fully deterministic way: at each step one finds the left-most occurrence of a sequence of types matching the left-hand side of (RED) and replaces this sequence with the type of the right-hand side of (RED). This deterministic algorithm always returns

a unique fa-structure and a unique type of the entry or replies negatively, if it comes to an irreducible sequence. Unfortunately this procedure is incorrect for many-argument types; for one-argument types it works well. In (Buszkowski 1998), the following counterexample has been found:

$$s/(n/n)nn,\ n/n,\ n,\ n/n,\ n.$$

This sequence reduces to s, if one reduces the last two types to n, then the whole to s, but this reduction does not fulfil Ajdukiewicz's requirement. Following this requirement, one should first reduce the second and the third type (together) to n, then the last pair to n, and obtain the irreducible sequence $s/(n/n)nn,\ n,\ n$. One can consider a formal language, where $I : s/(n/n)nn$, $f : n/n$, $g : n/n$, $a : n$, $b : n$. Let the meaning of $Ifab$ be $f(a) = b$. The expression $Ifagb$ is well-formed (it means $f(a) = g(b)$), but Ajdukiewicz's procedure rejects it.

This inadequacy can be removed in two ways (see (Buszkowski 1998)): (i) the reduction procedure is executed in a non-deterministic way: at any stage one chooses a reducible pattern of types and rewrites it according to (RED) (this routine is standard for AB-grammars, but it makes the unambiguity properties nontrivial), (ii) the reduction procedure remains deterministic but admits partial reductions:

$$\alpha/\beta_1 \ldots \beta_n, \beta_1, \ldots, \beta_i \Rightarrow |\alpha/\beta_{i+1} \ldots \beta_n.$$

Types with | can act as functors but not as arguments of other functors. Worth noticing, in (Ajdukiewicz 1935) such types are used for languages with variable-binding operators. For the example mentioned above, one reduces the first three types, which yields $|s/n,\ n/n,\ n$, then the last pair to n, and finally $|s/n,\ n$ to s.

Bidirectional one-valued AB-grammars can be both structurally and categorially ambiguous. The sequence of types:

$$(p/(q\backslash q))/q,\ q,\ q\backslash q$$

reduces to p with structure $(((p/(q\backslash q))/q,q)_1,q\backslash q)_1$ and to $p/(q\backslash q)$ with structure $(((p/(q\backslash q))/q),\ (q,\ q\backslash q)_2)_1$. The categorial and structural unambiguity, however, can be retained, if strings are replaced by phrase structures: for any phrase structure X there exists at most one pair (Y, α) such that Y is an fa-structure, α is a type, X is the ps-yield of Y, and the grammar assigns α to Y.

Therefore, for unidirectional one-valued AB-grammars one can represent fa-structures by their yields, and for bidirectional one-valued AB-grammars by their ps-yields. For any well-constructed unidirectional one-valued grammar G, the syntactically connected strings are precisely the yields of structures from $s(L^F(G))$, and the equivalence classes of

$\equiv_{L(G)}$, restricted to syntactically connected strings, coincide with the typed categories $L(G,\alpha)$, for $\alpha \in s(\mathcal{H}(G))$. The same is true for well-constructed bidirectional one-valued AB-grammars if one replaces strings by phrase structures and $\equiv_{L(G)}$ by $\equiv_{L^P(G)}$.

Now we briefly discuss the problem of determining basic and functor categories of the given language, especially a natural language. In practice, many different aspects play a role, *e.g.* analogies with logical formalisms, tradition, semantics, particular features of the language under consideration (a discussion of various factors can be found in (Marciszewski 1988)). Semantics justifies the qualification of sentences and names (proper nouns) as two basic categories. Intransitive (resp. transitive) verbs are treated like unary (resp. binary) predicates in first-order logic. Complete noun phrases are treated like generalized quantifiers; they act as functors on unary predicates as arguments. These options, however, are not obligatory, and there are good reasons for alternative solutions. Keenan and Faltz (1985) admit the basic category of complete noun phrases, whose subcategory consists of proper nouns; intransitive verbs act as functors on the complete noun phrases. The reasons are semantical: in (Keenan and Faltz 1985) the basic ontological categories, corresponding to the basic syntactic categories, are boolean algebras with some natural (set-theoretic) interpretations of 'and,' 'or,' 'not.' The ontological category of individuals is not boolean, but that of generalized quantifiers (*i.e.* families of sets of individuals) is boolean, and proper nouns are interpreted as particular families of sets of individuals, namely the principal ultrafilters in the boolean algebra of all sets of individuals.

Some algorithms which extract a grammar from a finite set of sentences, represented as fa-structures, were proposed in (Buszkowski 1987) for one-valued grammars and (Buszkowski and Penn 1990) for arbitrary AB-grammars. These algorithms employ unification of types, an adaptation of the Curry algorithm for determining the principal type of a combinator. Kanazawa (1996) further elaborated these methods toward a Gold-style paradigm of learning as identification in the limit (also for sentences represented as strings). In the last two decades this issue dominated the mathematical research in AB-grammars; see the textbook Moot and Retore (2012).

Finally, we will discuss semantic types, following Ajdukiewicz (1960). This paper outlines a semantical version of the approach from (Ajdukiewicz 1935). Semantic types correspond to ontological categories of denotations of expressions. Ajdukiewicz uses w as the type of truth values and i as the type of individuals. $\frac{\beta}{\alpha}$ is the type of functions which send arguments of type α to values of type β. So $\frac{w}{w}$ corresponds to unary truth-value functions, $\frac{w}{ww}$ to binary truth-value functions, $\frac{w}{i}$ to unary predicates, $\frac{w}{ii}$ to binary

predicates, and so on. The semantic category of type α can be defined as the set of expressions whose denotations are of type α. Of course, this definition assumes that the language is interpreted in a fixed model which determines the denotations of meaningful expressions. The denotation of a compound expression can be computed from the denotations of words by function application.

Today the ideas of (Ajdukiewicz 1960) are standard in type-theoretic semantics. This paper, however, was published in 1960, several years before the first semantical work of R. Montague. Nonetheless Ajdukiewicz could be influenced by some earlier proposals of a similar character, *e.g.* (Bocheński 1949) and (Suszko 1960), and higher-order logics, well elaborated in this time.

Semantic types do not uniquely indicate the syntactic roles of expressions. For instance, Latin words 'Johannes' and 'Petrum' are assigned i, but 'Johannes' can only be the subject and 'Petrum' the direct object of a simple declarative sentence (so both 'Johannes amat Petrum' and 'Petrum amat Johannes' express the same statement, whose functor is 'amat,' the first argument is 'Johannes,' and the second argument is 'Petrum'). Ajdukiewicz supplies expressions with positional markers (indices) which indicate the positions of these expressions in a sentence, represented as a fa-structure with functors always preceding their arguments (so functor markers can be omitted). For 'Mary sings and Alice dances' (my example), represented as (and (sings Mary) (dances Alice)), the whole sentence is supplied with 1, the main functor 'and' with (1, 0), its first argument (sings Mary) with (1, 1), its second argument (dances Alice) with (1, 2), 'sings' with (1, 1, 0), 'Mary' with (1, 1, 1), 'dances' with (1, 2, 0), 'Alice' with (1, 2, 1). Ajdukiewicz argues that these positional markers are similar to inflections, and the language in which all words are supplied with such markers is a "purely inflectional language'.'

In this way, Ajdukiewicz attributes to types an exclusively semantical role, while functor-argument relations are regulated by positional markers. Although the idea of a purely inflectional language seems attractive, this concrete realization is not satisfactory. Positional markers of words, proposed here, bring just another encoding of a single fa-structure; they lack sense, if not related to a particular structure (up to isomorphism), while inflections in inflectional languages are not restricted to any particular form of sentence. The markers, given above, are useless for 'dear Alice sings softly.'

AB-grammars and other type grammars, considered later on, are suitable for positional languages, as \ and / in directional types $\alpha\backslash\beta$, β/α encode the information on the positions of the functor and the argument and

nothing else. Inflectional languages need more information encoded in types or some additional syntactic constraints.

To attain a better concordance of syntactic and semantic categories, Buszkowski (1989) proposes a semantics sensitive to syntax. Syntactic types with \, / can be treated as semantic types. The ontological category of type $\alpha\backslash\beta$ (resp. β/α) consists of pairs (r, f) (resp. (l, f)) such that f is a function from the ontological category of type α to that of type β, and r, l are position markers. If (r, f) (resp. (l, f)) is a denotation of X, then X can be interpreted as f, provided that X acts as the right (resp left) functor in the structure under consideration. In Section 3 we show that also stronger type logics can be related to models of this kind. Again, this approach works well for (fragments of) positional languages, but more syntactic information must be encoded in semantic types for inflectional languages. This way is quite opposite to that of (Ajdukiewicz 1960).

3. Syntactic Categories in Lambek Grammars

AB-grammars implicitly assume the following rule: if $u : \alpha\backslash\beta$ (resp. $u : \beta/\alpha$), then for any string v such that $v : \alpha$, there holds $vu : \beta$ (resp. $uv : \beta$). Lambek (1958) replaces 'if-then' by 'if and only if.' This leads to new reduction laws. Since $u : \alpha$ entails $uv : \beta$, for any v of type $\alpha\backslash\beta$, then u is of type $\beta/(\alpha\backslash\beta)$; this justifies the type-raising law $\alpha \Rightarrow \beta/(\alpha\backslash\beta)$ and its dual form $\alpha \Rightarrow (\beta/\alpha)\backslash\beta$ has a symmetric justification. In particular, $n \Rightarrow s/(n\backslash s)$ can be read: every proper noun is a noun phrase. This type-raising was implicitly applied by Montague (1974) who lifted up proper nouns to the type of noun phrase in order to interpret the conjunction 'and' as a noun phrase conjunction (in models, as the intersection of families of sets of individuals) in contexts like 'John and a student.' Also, if $u : \alpha\backslash\beta$ and $v : \beta\backslash\gamma$, then $wuv : \gamma$, for any $w : \alpha$, and consequently $uv : \alpha\backslash\gamma$. This justifies the composition law $\alpha\backslash\beta, \beta\backslash\gamma \Rightarrow \alpha\backslash\gamma$, and a similar argument supports $\alpha/\beta, \beta/\gamma \Rightarrow \alpha/\gamma$. In particular, $s/s, s/(n\backslash s) \Rightarrow s/(n\backslash s)$ enables the classification of 'not every student' as a (negative) noun phrase.

Lambek's approach changes the *static* typing of expressions in AB-grammars into a *dynamic* one; each type can be transformed into infinitely many new types. On the level of syntax, these new types correspond to different syntactic roles of one expression; in semantics, they yield the types of possible denotations of the expression.

Two basic versions of the Lambek calculus are Associative Lambek Calculus (L), due to (Lambek 1958), and Nonassociative Lambek Calculus (NL), due to (Lambek 1961). In both systems formulae are built from variables (atomic types) by means of three connectives $\cdot$, \, /, called product,

right residuation (right implication, right division) and left residuation (left implication, left division), respectively. These connectives are interpreted in algebras of languages $\wp(\Sigma^+)$ as follows:

$$L_1 \cdot L_2 = \{uv : u \in L_1, v \in L_2\},$$
$$L_1 \backslash L_2 = \{u \in \Sigma^+ : L_1 \cdot \{u\} \subseteq L_2\}, L_1 / L_2 = \{u \in \Sigma^+ : \{u\} \cdot L_2 \subseteq L_1\},$$

for $L_1, L_2 \subseteq \Sigma^+$. Σ^+ can be replaced by Σ^*, if one regards languages with ϵ, and by Σ^P, if one deals with ps-languages (one replaces u by X, v by Y, and uv by (XY)). These algebras are called *language models*.

General algebraic models are *residuated groupoids*. A residuated groupoid is an ordered algebra $\mathscr{A} = (A, \cdot, \backslash, /, \leq)$ such that $(A, \leq)$ is a partially ordered set, and $\cdot$, $\backslash$, $/$ are binary operations on A, satisfying the residuation laws:

$$x \cdot y \leq z \text{ iff } y \leq x \backslash z \text{ iff } x \leq z / y,$$

for all $x, y, z \in A$. *A residuated semigroup* is a residuated groupoid such that $\cdot$ is associative, *i.e.* $(A, \cdot)$ is a semigroup. For any residuated groupoid, $\cdot$ is monotone in both arguments, hence $(A, \cdot, \leq)$ is a partially ordered groupoid. $\wp(\Sigma^P)$ is a residuated groupoid ($\subseteq$ is the order), and $\wp(\Sigma^+)$ is a residuated semigroup.

NL and L can be presented as (intuitionistic) sequent systems. An ND-system for the product-free L (*i.e.* L restricted to formulae without $\cdot$) adds to the ND-system for AB the introduction rules:

(I$\backslash$) $\dfrac{\alpha, \Gamma \Rightarrow \beta}{\Gamma \Rightarrow \alpha \backslash \beta}$,

(I/) $\dfrac{\Gamma, \alpha \Rightarrow \beta}{\Gamma \Rightarrow \beta \backslash \alpha}$,

with the constraint $\Gamma \neq \epsilon$. Dropping this constraint yields the product-free L*; this system admits sequents with empty antecedents.

For NL, antecedents of sequents are formula structures (in the ps-format). The ND-system for AB is extended by (I$\backslash$) with the premise $(\alpha, \Gamma) \Rightarrow \beta$ and (I/) with the premise $(\Gamma, \alpha) \Rightarrow \beta$. Admitting the empty structure Λ (the unit of the operation $(\ ,\ )$), yields the product-free NL*.One writes $\Rightarrow \alpha$ for $\Lambda \Rightarrow \alpha$.

In L one adds rules for product:

(E$\cdot$) $\dfrac{\Gamma, \alpha, \beta, \Gamma' \Rightarrow \gamma; \Delta \Rightarrow \alpha \cdot \beta}{\Gamma, \Delta, \Gamma' \Rightarrow \gamma}$,

(I$\cdot$) $\dfrac{\Gamma \rightarrow \alpha; \Delta \Rightarrow \beta}{\Gamma, \Delta \Rightarrow \alpha \cdot \beta}$.

In NL, the first premise of (E$\cdot$) is $\Gamma[(\alpha, \beta)] \Rightarrow \gamma$ and the conclusion is $\Gamma[\Delta] \Rightarrow \gamma$; the conclusion of (I$\cdot$) is $(\Gamma, \Delta) \Rightarrow \alpha \cdot \beta$.

In algebraic models, sequents are interpreted as follows. The nonempty antecedent Γ is interpreted as the formula $f(\Gamma)$, obtained by replacing each comma by $\cdot$, and $\Rightarrow$ is interpreted as $\leq$. The empty antecedent is interpreted as 1, *i.e.* the unit element, satisfying $1 \cdot x = x = x \cdot 1$, for any element x. The language $\{\epsilon\}$ is the unit in language models $\wp(\Sigma^*)$. $\Sigma^P{}^*$ denotes $\Sigma^P \cup \{\Lambda\}$ (the empty structure is the unit in $\Sigma^P{}^*$). Then, $\{\Lambda\}$ is the unit in $\wp(\Sigma^P{}^*)$. A sequent $\Gamma \Rightarrow \alpha$ is true in $\mathscr{A}$ for a valuation μ (*i.e.* a homomorphism from the free algebra of formulae to $\mathscr{A}$), if $\mu(f(\Gamma)) \leq \mu(\alpha)$; it is *valid* in a class of algebras, if it is true in every algebra from this class for all valuations.

L is complete with respect to residuated semigroups, this means: the sequents provable in L are precisely the sequents valid in this class. L* is complete with respect to residuated monoids (*i.e.* residuated semigroups with 1), NL with respect to residuated groupoids, and NL* with respect to residuated unital groupoids (*i.e.* residuated groupoids with 1). In each system, $\Gamma \Rightarrow \alpha$ is provable if and only if $f(\Gamma) \Rightarrow \alpha$ is provable.

These logics are often presented as sequent systems in which the elimination rules are replaced by the left introduction rules (they introduce a connective in the antecedent). In NL the left introduction rule for product is: from $\Gamma[(\alpha, \beta)] \Rightarrow \gamma$ infer $\Gamma[\alpha \cdot \beta] \Rightarrow \gamma$ (see (Buszkowski 1997) for the full list). The cut-rule:

(CUT)in NL $\dfrac{\Gamma[\alpha] \Rightarrow \beta; \Delta \Rightarrow \alpha}{\Gamma[\Delta] \Rightarrow \beta}$

(CUT)in L $\dfrac{\Gamma, \alpha, \Gamma' \Rightarrow \beta; \Delta \Rightarrow \alpha}{\Gamma, \Delta, \Gamma' \Rightarrow \beta}$

plays a special role. It is a structural rule (introducing no new formula). It is necessary in theories (logics augmented with assumptions, *i.e.* nonlogical axioms) for their completeness, but not in pure logics: every provable sequent can be proved without (CUT). This *cut-elimination theorem* was proved by Lambek (1958) for L and Lambek (1961) for NL. It also holds for other type logics considered here. The most important consequences are the decidability of these logics and *the subformula property*: every provable sequent $\Gamma \Rightarrow \alpha$ has a (cut-free) proof in which all sequents consist of subformulae of the formulae occurring in $\Gamma \Rightarrow \alpha$.

Other standard structural rules are exchange (e), integrality (or:left weakening) (i), contraction (c), and associativity (a):

(e) $\dfrac{\Gamma[(\Delta_1, \Delta_2)] \Rightarrow \alpha}{\Gamma[(\Delta_2, \Delta_1)] \Rightarrow \alpha}$,

(i) $\dfrac{\Gamma[\Delta_i] \Rightarrow \alpha}{\Gamma[(\Delta_1, \Delta_2) \Rightarrow \alpha]}$,

(c) $\dfrac{\Gamma[(\Delta, \Delta)] \Rightarrow \alpha}{\Gamma[\Delta] \Rightarrow \alpha}$,

(a) $\dfrac{\Gamma[(\Delta_1,\Delta_2),\Delta_3]\Rightarrow\alpha}{\Gamma[(\Delta_1,(\Delta_2,\Delta_3))]\Rightarrow\alpha}$.

NL with (a) is equivalent to L. Logics with (e) are interpreted in commutative algebras ($x \cdot y = y \cdot x$ for all elements x, y); then $x\backslash y = y/x$, and one writes $x \to y$ for both. So the connectives of L with (e) are $\cdot$, $\to$, and similarly for NL with (e).

Substructural logics are often defined as axiomatic and rule extensions of Full Lambek Calculus (FL): L* enriched with constants 1, 0 and lattice connectives $\wedge$, $\vee$ (optionally also constants $\bot$, $\top$, interpreted as the least element and the greatest element). 1 is interpreted as the unit element for product and 0 as an arbitrary element (one defines two negations $\sim x = x\backslash 0$, $-x = 0/x$; in commutative algebras they collapse to one negation $\neg$). The algebraic models of FL are residuated lattices, *i.e.* lattice-ordered residuated monoids; see Galatos, Jipsen, Kowalski and Ono (2007). The nonassociative version FNL corresponds to lattice-ordered residuated unital groupoids; see Galatos, Jipsen, Kowalski and Ono (2007) and Buszkowski (2011). According to the terminology of linear logics, $\cdot$, $\backslash$, $/$, 1, 0 are called *multiplicative* connectives and constants, while $\wedge$, $\vee$, $\bot$, $\top$ are called *additive* connectives and constants. FL is a conservative extension of L* and FNL of NL*. L* is the multiplicative fragment of FL (without 1, 0).

Many important nonclassical logics belong to this family. For instance, intuitionistic logic (IL) amounts to FL with (e), (i), (c) and the definition $0 = \bot$, multiplicative-additive linear logic (MALL) to FL with (e) and the axiom $\neg\neg\alpha \Rightarrow \alpha$, and Łukasiewicz logic $Ł_\infty$ to FL with (e), (i), the definition $0 = \bot$ and the axiom $(\alpha \to \beta) \to \beta \Rightarrow \alpha \vee \beta$. Noncommutative and nonassociative versions of these logics are also studied.

Type grammars usually apply multiplicative substructural logics, which can be interpreted in language models: NL, NL*, L, L*. Logics of semantic types are formalized with (e) and, possibly, other structural rules. Logics with $\wedge$, $\vee$ are less popular, although there are good reasons for them; see below. One also considers logics with new residuated operations, *e.g.* unary modalities $\diamond_i$ and their residuals $\Box_i^{\downarrow}$. In algebras, $\diamond$ and $\Box^{\downarrow}$ are connected by the unary residuation law: $\diamond x \leq y$ iff $x \leq \Box^{\downarrow} y$. (In general, $\Box^{\downarrow}$ is different from $\Box$, *i.e.* the De Morgan dual of $\diamond$.) L and NL with unary modalities were applied by *e.g.* Moortgat (1997) and Morrill (1994) to allow a controlled usage of some structural rules (in a similar role that exponentials are used in linear logics).

Systems not allowing empty antecedents of sequents, like NL, L, are not popular among logicians; no single formula α (*i.e.* no sequent $\Rightarrow \alpha$) is provable, hence these logics cannot be presented as Hilbert-style systems, nor easily compared with other nonclassical logics. In type grammars, however, they are extensively used, starting from (Lambek 1958) (also AB

is a logic of this kind). Logics with empty antecedents are too strong, in a sense. Adjectives can be typed N/N, where N is the type of common noun (so adjectives are treated as common noun modifiers) and adverbs $(N/N)/(N/N)$ (adjective modifiers). In semantics, adjectives act as functions which send a set of individuals to its subset and adverbs act as higher-order functions which modify adjectival functions. In L* $\alpha/\alpha \Leftrightarrow (\alpha/\alpha)/(\alpha/\alpha)$ is provable (this means: sequents in both directions are provable), hence adjectives are indistinguishable from adverbs. This is unacceptable for linguistics ('a beautiful student' is correct, but 'a very student' is not). One can solve this problem by introducing new types, *e.g.* a new atomic type for adjectives, but it complicates the grammar and is less satisfactory from the semantic viewpoint.

On the other hand, both kinds of logics (*i.e.* with and without empty antecedents) are closely related. A faithful interpretation of FL in its version without empty antecedents has been shown in (Buszkowski 2014); this interpretation also works for several stronger logics, allowing cut elimination.

On the basis of L and its variants, one can analyze compound expressions more easily and deeply than in AB-grammars. With 'John': n, 'likes': $(n\backslash s)/n$, 'some': $((s/n)\backslash s)/N$, 'teacher': N, we have 'John likes some teacher': s, since the sequent:

$$n, (n\backslash s)/n, ((s/n)\backslash s)/N, N \Rightarrow s$$

is provable in L. This sequent is not provable in AB; an AB-grammar must also assign $n\backslash(s/n)$ to 'likes.' (The associative law $\alpha\backslash(\beta/\gamma) \Leftrightarrow (\alpha\backslash\beta)/\gamma$ is provable in L.) Another example is 'he likes her' with 'he': $s/(n\backslash s)$ and 'her': $(s/n)\backslash s$. The sequent:

$$s/(n\backslash s), (n\backslash s)/n, (s/n)\backslash s \Rightarrow s$$

is provable in L but not in AB, and an AB-grammar needs additional types, *e.g.* 'he': $(s/n)/((n\backslash s)/n)$. (The Geach law $\alpha/\beta \Rightarrow (\alpha/\gamma)/(\beta/\gamma)$ is provable in L, and similarly for its dual with \.) In general, AB-grammars must assign many types to one word to account for different syntactic roles of this word, while L-grammars can derive the other types from some main types and explain logical relations between types.

Associative logics are essentially stronger than their nonassociative versions. Type-raising laws and expansion laws are provable in NL, but associative laws, composition laws and Geach laws are not. It may be argued that associative logics are too strong for type grammars. Lambek's example uses 'Mary': n, 'poor': n/n (as 'poor John': n), 'him': $(s/n)\backslash s$, and 'likes,' 'John' typed as above. On the basis of L 'Mary likes poor John': s,

but also ‘Mary likes poor him’: s, though the latter is incorrect in English. The sequent:

(4) $\quad n, (n\backslash s)/n, n/n, (s/n)\backslash s \Rightarrow s$

is provable in L but not in NL (this means: no sequent $\Gamma \Rightarrow s$ such that the antecedent of (4) is the yield of Γ is provable in NL). This was a reason for replacing L by NL in Lembek (1961). Moortgat (1997) treats NL as a basic type logic and increases its power by adding modalities $\diamond$, $\square^{\downarrow}$.

Now we briefly discuss some relations of Lambek grammars to AB-grammars.

Every L-grammar G can be transformed into an infinite AB-grammar $\overline{G}$: $I_G(a)$ contains all types β such that $\alpha \Rightarrow \beta$ is provable in L, for some $\alpha \in I_G(a)$. One shows $L(G, \alpha) = L(\overline{G}, \alpha)$, for any type α, and consequently, $L(G) = L(\overline{G})$. An analogous transformation works for NL-grammars.

Since the antecedents of sequents in NL are formula structures of the form of phrase structures, then NL-grammars naturally assign types to phrase structures. Similarly as in Section 2, I_G is extended for all structures from Σ_G^P by setting: $I_G((XY)) = \{(\Gamma, \Delta) : \Gamma \in I_G(X), \Delta \in I_G(Y)\}$. For NL-grammars and L-grammars, the types of fa-structures can be defined as those assigned by the infinite AB-grammar $\overline{G}$; by dropping structure markers we get the types of ps-structures and strings. For NL-grammars, the second typing of phrase structures is equivalent to the first one. In NL-grammars and L-grammars, different fa-structures with the same ps-yield are indistinguishable (this means: they are assigned the same types) and in L-grammars this also holds for different phrase structures with the same yield. The possibility of interchanging functors and arguments is a result of type-raising laws.

Consequently, for an NL-grammar G, $L^F(G)$ consists of all fa-structures whose ps-yield belongs to $L^P(G)$; for an L-grammar G, both $L^F(G)$ and $L^P(G)$ consist of all structures (of the appropriate kind) whose yield belongs to $L(G)$. So NL-grammars are grammars of phrase structures, and L-grammars are grammars of strings.

Kandulski in (1988a) and (1988b) proves the P-equivalence of type grammars based on NL and AB; hence NL-grammars are equivalent to ϵ-free CFGs. This proof shows that for any NL-grammar G, one can construct an AB-grammar G' such that $L^P(G) = L^P(G')$ and $I_G(a) \subseteq I_{G'}(a) \subseteq I_G(a)$, for any $a \in \Sigma_G$. So G' is a finite fragment of the infinite AB-grammar $\overline{G}$. Analogous results for product-free NL-grammars were earlier proved in Buszkowski (1986b).

The equivalence of L-grammars and ϵ-free CFGs was proved by Pentus (1993). Hence L-grammars are equivalent to AB-grammars. The

P-equivalence does not hold: L-grammars allow all possible phrase structures of the generated strings, hence they can generate ps-languages of infinite degree.

Buszkowski (1996) shows that every product-free L-grammar G is equivalent to some AB-grammar G', extending G and being a finite fragment of $\overline{G}$, as above. G' can be treated as a natural AB-grammar equivalent to G.

We turn to the main topic of this paper: syntactic categories.

By the equivalence results discussed above, the theory of AB-grammars, presented in Section 2, can be applied, essentially, to NL-grammars and L-grammars if we replace the latter with (natural) AB-grammars equivalent to them. In this sense Ajdukiewicz's approach to syntactic categories preserves its merits for grammars based on Lambek logics. As a rule, a direct application of this approach to Lambek grammars is impossible or, at least, problematic.

The strict concordance of typed categories and substitution classes is impossible even for one-valued Lambek grammars. In opposition to AB, Lambek logics provide laws of the form $\alpha \Rightarrow \beta$ such that $\alpha \neq \beta$, *e.g.* type-raising laws (in NL and L) and Geach laws (in L). If $\alpha \Rightarrow \beta$ is provable, then $L(G, \alpha) \subseteq L(G, \beta)$; if, additionally, $\beta \Rightarrow \alpha$ is not provable and $\beta \in I_G(a)$, then $a \in L(G, \beta)$, $a \notin L(G, \alpha)$, hence $L(G, \alpha) \subset L(G, \beta)$. The same holds for typed categories consisting of structures. Accordingly, typed categories do not partition the universe of (well-formed) expressions, hence they cannot coincide with substitution classes.

In language models of L, all typed categories are generated from basic categories by the operations $\cdot$, \, /. Let P be a set of atomic types. The basic categories are the values of a map $c : P \mapsto \wp(\Sigma^+)$. The map c is uniquely extended to all types on P, by the homomorphism equations:

(5) $\quad c(\alpha \cdot \beta) = c(\alpha) \cdot c(\beta)$, $c(\alpha\backslash\beta) = c(\alpha)\backslash c(\beta)$, $c(\alpha/\beta) = c(\alpha)/c(\beta)$.

For an L-grammar G, by P_G we denote the set of atomic types involved in G. For any $p \in P_G$, we define $c_G(p) = L(G, p)$. The map c_G can be extended as above. We are faced with the natural problem of whether typed categories in the grammar are compatible with typed categories in the model. Buszkowski (1982) shows that the strong condition: $c_G(\alpha) = L(G, \alpha)$, for all product-free types α on P_G, cannot be attained for L-grammars, nor AB-grammars.

A type grammar G is said to be *weakly complete*, if this condition holds for all $\alpha \in s(\mathcal{T}(G))$, and *correct*, if $a \in c_G(\alpha)$ whenever $\alpha \in IG(a)$, for all types α and words a.

Every weakly complete grammar is correct. Not all grammars are correct. For instance, the AB-grammar G with $a : s/(s/s)$, $b : s/s$ is incorrect; bb

$\in c_G(s/s)$, but $bb \notin L(G,s/s)$, hence $abb \notin c_G(s)$, and consequently, $a \notin c_G(s/(s/s))$. The analogous grammar based on L is weakly complete, hence correct. Nonetheless there exist incorrect L-grammars. By extending Σ_G, every product-free L-grammar G can be extended to some weakly complete L-grammar which is equivalent to G for strings on Σ_G. If an AB-grammar is correct, then it is equivalent to the L-grammar having the same lexicon, the same initial type assignment and the same designated type. If G is correct, then c_G is the least map c satisfying: $a \in c(\alpha)$ whenever $\alpha \in I_G(a)$ (with respect to the partial ordering: $c \leq c'$ if and only if $c(p) \subseteq c'(p)$ for all $p \in P_G$). This resembles the characterization of context-free languages as the minimal solutions of finite systems of linear equations in languages. Analogous results can be obtained for NL-grammars.

Notice that the incorrect AB-grammar, presented above, is one-valued and well-constructed. So even such AB-grammars, though fully compatible with Ajdukiewicz's postulates for syntactic categories, need not be compatible with Lambek's approach. This is not surprising, since the two approaches essentially differ in the interpretation of functor types. For AB-grammars, language models should be replaced by more general structures; instead of (5) one only assumes $c(\alpha\backslash\beta) \subseteq c(\alpha)\backslash c(\beta)$, and similarly for β/α.

The mathematical research in type logics focused on the completeness of type logics with respect to language models, the equivalence of categorial grammars and production grammars (especially CFGs), the computational complexity of type logics and categorial grammars, and others. Here we do not discuss these matters in detail; the reader is referred to (Buszkowski 1997), (Buszkowski 2010), (Moortgat 1997) and (Moot and Retore 2012).

Pentus (1995) proves the completeness of L with respect to language models $\wp(\Sigma^+)$; this also holds for L* and the corresponding language models $\wp(\Sigma^*)$. The strong completeness does not hold, but it holds for the product-free fragments of these logics, even with $\wedge$, $\top$. In language models we interpret $\wedge$, $\vee$ as the set-theoretic intersection ($\cap$) and union ($\cup$) of languages, and $\top$ as the total language.

Types with $\wedge$, $\vee$ are not often used in type grammars, but there are good reasons to work with them. Lambek (1961) applied $\wedge$ to replace a multi-valued type assignment $a : \alpha_1, \ldots, \alpha_n$ with the one-valued assignment $a : \alpha_1 \wedge \cdots \wedge \alpha_n$. Kanazawa (1992) considered types sensitive to features, *e.g.* np$\wedge$sing (singular noun phrase), np$\wedge$pl (plural noun phrase); he also proved that FL-grammars generate some languages which are not context-free. The two types of noun phrase, $s/(n\backslash s)$ (subject) and $(s/n)\backslash s$ (object), yield the type $((s/(n\backslash s)) \wedge ((s/n)\backslash s))/N$ of determiners. Lambek (2008) links the subtypes with the main type by nonlogical axioms (assumptions), *e.g.*

$\pi_k \Rightarrow \pi$, $s_k \Rightarrow s$; see Section 1. A similar effect can be reached by defining $\pi = \pi_1 \vee \pi_2 \vee \pi_3$, $s = s_1 \vee s_2$; then, the type change formalism remains a pure logic (it is a theory in (Lambek 2008), a violation of lexicality).

FL is not complete with respect to language models, *e.g.* the distributive laws for $\wedge$, $\vee$ are valid in language models but not provable in FL. One can add to FL the axiom:

(D) $\alpha \wedge (\beta \vee \gamma) \Rightarrow (\alpha \wedge \beta) \vee (\alpha \wedge \gamma)$.

The resulting logic is called Distributive Full Lambek Calculus (DFL), and DFNL is an analogous extension of FNL. The remaining distributive laws are provable. The present axiomatization does not allow cut elimination, but cut-free systems for these logics exist; see (Kozak 2009).

An interesting linguistic interpretation of FL and related logics, not assuming the distributive laws for $\wedge$, $\vee$, uses Syntactic Concept Lattices (SCLs), applied by Clark (2011) in some learning procedures for formal grammars. By a context on Σ one means a pair $(u, w) \in (\Sigma^*)^2$. Let $L \subseteq \Sigma^*$ be a fixed language. For any $U \subseteq \Sigma^*$, one defines $U^{\triangleright}$ as the set of all contexts (u, w) such that $uvw \in L$, for all $v \in U$. For any $S \subseteq (\Sigma^*)^2$, one defines $S^{\triangleleft}$ as the set of all $v \in \Sigma^*$ such that $uvw \in L$, for all $(u, w) \in S$. The operations $^{\triangleright}$, $^{\triangleleft}$ form a Galois connection ($U \subseteq S^{\triangleleft}$ if and only if $S \subseteq U^{\triangleright}$), and consequently, the operation $C(U) = U^{\triangleright\triangleleft}$ is a closure operation on $\wp(\Sigma^*)$. Furthermore, C is a nucleus (it satisfies $C(U) \cdot C(V) \subseteq C(U \cdot V)$). The closed sets (*i.e.* satisfying $C(U) = U$) are called the syntactic concepts determined by L. Let C_L denote the family of syntactic concepts determined by L. One shows that C_L is closed under \, / (defined in $\wp(\Sigma^*)$) and $\cap$. One also defines $U \cdot_C V = C(U \cdot V)$, $U \cup_C V = C(U \cup V)$, $1_C = C(\{\epsilon\})$. C_L with these operations is a residuated lattice (not necessarily distributive), called the SCL determined by L. FL is strongly complete with respect to SCLs (Wurm 2013). Analogous results can be obtained for FNL and logics not allowing empty antecedents if one modifies SCLs appropriately.

Syntactic concepts in the sense of (Clark 2011) can be interpreted as syntactic categories determined by the language L. This is a generalization of Ajdukiewicz's idea of a syntactic category as a substitution class. Although syntactic concepts are not equivalence classes of the relation of mutual substitutability, they are determined by sets of contexts. For instance, in the nonassociative format, the category of singular noun phrases is determined by the single context (_ exists), since (X exists) is a correct sentence if and only if X is a singular noun phrase. This remarkable generalization of Ajdukiewicz's approach has not yet been developed in the theory of type grammars. A similar idea of syntactic categories was elaborated in the *contextual grammars* of S. Marcus.

Finally, we will briefly discuss logics of semantic types. Following van Benthem (1986), we admit two atomic types: e (entity) and t (truth value); they correspond to i and w of (Ajdukiewicz 1960). Other atomic types can also be considered, *e.g.* the type of quantifiers (interpreting noun phrases) was taken as atomic in (Keenan and Faltz 1985). Functional types are of the form $\alpha \to \beta$; one also writes $(\alpha\beta)$, for brevity.

Some simple semantic types are: (tt) (unary truth-value function), $(t(tt))$ (binary truth-value function), (et) (unary predicate, *i.e.* set of individuals), $(e(et))$ (binary predicate), $((et)t)$ (quantifier, *i.e.* family of sets of individuals), $((et)(et))$ (operation on unary predicates, *e.g.* complement), $((et)((et)(et)))$ (binary operation on unary predicates, *e.g.* union, intersection).

No serious presentation of type-theoretic semantics applied to language is possible in this short essay; the reader may consult any book on Montague Grammar and similar approaches, *e.g.* (Montague 1974), (Keenan and Faltz 1985), (van Benthem 1986), (Partee, ter Meulen and Wall 1990) and (Moot and Retore 2012).

The product-free L with (e) was proposed by van Benthem (1986) as a logic of semantic types (sometimes referred to as the Lambek-van Benthem calculus). In this logic one proves semantic counterparts of the laws provable in L. The type-raising law takes the form $\alpha \Rightarrow ((\alpha\beta)\beta)$. Its instance $e \Rightarrow ((et)t)$changes the type of individuals to the type of quantifiers, a move anticipated by R. Montague; see the beginning of this section. The Geach law $(\alpha\beta) \Rightarrow ((\gamma\alpha)(\gamma\beta))$ yields $(tt) \Rightarrow ((et)(et))$; this shifts the initial type (tt) of 'not' to the type of boolean complement on sets of individuals, as in (John (is (not happy))). Also $(tt) \Rightarrow (((et)t)((et)t))$ shifts (tt) to the type of boolean complement on families of sets of individuals, as in ((not (every student)) came).

The Curry-Howard isomorphism is a correspondence between proofs in ND-systems and typed lambda-terms. The ND-system for the product-free L with (e) admits the axioms (Id) and the rules:

(E→) $\dfrac{\Gamma \Rightarrow \alpha \to \beta; \Delta \Rightarrow \alpha}{\Gamma,\Delta \Rightarrow \beta}$,

(I→) $\dfrac{\Gamma,\alpha \Rightarrow \beta}{\Gamma \Rightarrow \alpha \to \beta}$.

Here the antecedents of sequents are (nonempty) finite multisets of formulae; the comma stands for the union of multisets. Proofs can be encoded by typed lambda-terms. The axiom $\alpha \Rightarrow \alpha$ is encoded by $x : \alpha$. The elimination rule (E→) corresponds to application: if $M : \alpha \to \beta$ and $N : \alpha$ then $MN : \beta$, and the introduction rule (I→) to abstraction: if $M : \beta$ and $x : \alpha$ then $\lambda x.M : \alpha \to \beta$.

Let us consider the proof of $e \Rightarrow ((et)t)$ and its encoding. From $(et) \Rightarrow (et)$ $(x : (et))$ and $e \Rightarrow e$ $(y : e)$, we get (et), $e \Rightarrow t$ $(xy : t)$, by (E→). Then (I→) yields $e \Rightarrow ((et)t)$ $(\lambda x.xy{:}((et)t))$.

One interprets this formalism in a fixed model, *i.e.* a hierarchy of semantic domains (ontological categories) D_α, for semantic types α. If one valuates the free variable y with an individual $d \in D_e$, then $\lambda x.xy$ denotes the family of all $U \subseteq D_e$ such that $d \in U$ (sets, families of sets, *etc*. are identified with their characteristic functions). Thus, the proof of $e \Rightarrow ((et)t)$ is encoded by a lambda-term which determines a semantic transformation: the initial denotation d (an individual) is sent to the higher-order denotation $\lambda x^{(et)}.xy$ (a quantifier, here: the principal ultrafilter determined by d). This is a general paradigm: by the Curry-Howard isomorphism, proofs in this system determine semantic transformations, which modify the initial denotations of expressions.

A proof of $(tt) \Rightarrow ((et)(et))$ is encoded by $\lambda x^{(et)}y^{e}.z^{(tt)}(xy) : ((et)(et))$. If z is valuated by the truth-value function of negation, then this term denotes the boolean complement on sets of individuals, *i.e.* the denotation of 'not' in *e.g.* (John (is (not happy))).

On the other hand, $(t(tt)) \Rightarrow ((et)((et)(et)))$, needed to shift the initial type of 'and,' 'or' to the type of predicate conjunction, as in (Mary (sings and dances)), cannot be proved in L with (e). The contraction rule (c) is needed to infer this law from $(t(tt))$, $(et),e,(et)$, $e \Rightarrow t$ (provable in L with (e)). Thus, it is reasonable to admit more structural rules in logics of semantic types.

Proofs in the ND-system for L with (e) precisely correspond to the lambda-terms fulfilling the following constraints: (c1) each subterm has a free variable, (c2) no subterm has more than one occurrence of the same free variable, (c3) for any subterm $\lambda x.M$, x is free in M. Dropping (c1) amounts to admitting empty antecedents, dropping (c2) adds contraction, and dropping (c3) adds integrality.

It is well known that the normalization procedure for typed lambda-terms corresponds to proof normalization in ND-systems. Every sequent provable in the product-free L with (e) possesses only finitely many normal proofs, so the corresponding lambda-terms define only finitely many semantic transformations. In other words, *every provable sequent admits only finitely many semantic readings*; this result is due to van Benthem (1986). This does not hold for logics with contraction.

Syntactic types can be mapped to semantic types. The map m can be defined on atomic types by $m(s) = t$, $m(n) = e$, $m(N) = (et)$ *etc*.; then, it is extended to all types by $m(\alpha\backslash\beta) = m(\beta/\alpha) = (m(\alpha)m(\beta))$. Every proof in the product-free L can be interpreted as a proof in L with (e), if one replaces

each type α by $m(\alpha)$. Consequently, syntactic derivations in L-grammars determine semantic transformations, described above.

The map m is not one-one: different syntactic types collapse to one semantic type. Semantic types ignore the directionality. On the basic level, N and $n\backslash s$ are interpreted as (et), although the syntactic roles of common nouns and verb phrases are completely different.

As we have noted at the end of Section 2, semantics can be made sensitive to syntactic roles. Directional types $\alpha\backslash\beta$ and β/α can be used as semantic types. $D_{\alpha\backslash\beta}$ (*resp.* $D_{\beta/\alpha}$) is defined as the set of pairs (r, f) (resp. (l, f)) such that $f : D_\alpha \mapsto D_\beta$.

In this approach, noncommutative type logics L, L* *etc*. can directly be applied as logics of semantic types. The appropriate version of Curry-Howard isomorphism relates proofs in these logics (presented as ND-systems) with directional lambda-terms, employing directional types, two lambdas λ^r and λ^l, and appropriately modified applications. The term construction rules are: (1) $(MN)_2 : \beta$, if $M : \alpha$, $N : \alpha\backslash\beta$, (2) $(MN)_1 : \beta$, if $M : \beta/\alpha$, $N : \alpha$, (3) $\lambda^r x.M : \alpha\backslash\beta$, if $x : \alpha$, $M : \beta$, (4) $\lambda^l x.M : \beta/\alpha$, if x : α, $M : \beta$. The directional lambda calculus behaves like the standard one with regard to fundamental logical and computational properties (strong normalization, the Curry-Howard isomorphism). These ideas were announced in *e.g.* Buszkowski in (1989) and (1997) and further worked out by Wansing (1992).

Within this framework the collapse of different syntactic categories into one semantic category can easily be removed. Although common nouns may be interpreted as functions from D_e to D_t, they are not treated as functors: f is neither (r, f), nor (l, f). Thus, D_N is a basic ontological category, consisting of such functions, but $D_N \neq D_{e\backslash t}$, the latter consisting of pairs (r, f), for $f \in D_N$. As a consequence, the semantic category of type N does not collapse with the semantic category of type $e\backslash t$. Going this way, one attains a better compatibility of syntactic and semantic categories in Lambek grammars.

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Jan Woleński

TRUTH-THEORIES IN THE LVOV-WARSAW SCHOOL[1]

1. Introduction

Philosophical reflection on the concept of truth was among the favorite topics in the Lvov-Warsaw School (LWS hereafter; I will also use the denomination "Polish analytic philosophy"). It culminated in Tarski's famous semantic theory of truth (see Tarski 1933), one of the most important contributions to analytic philosophy and perhaps the most important Polish contribution to world-philosophy. However, Tarski had his predecessors in Poland. On the other hand, Polish (or more specifically, undertaken in LWS) contributions to aletheiology (let me use this word in referring to the philosophy of truth) cannot be reduced to preceding or being associated with Tarski's conception. Let me mention, for example, many-valued logic and its relation to the problem of truth.

In general, LWS defended the Aristotelian tradition in aletheiology. In fact, the consensus theory of truth developed by Poznański and Wundheiler (see Poznański, Wundheiler 1934) was the only notably exception.[2] In fact, the popular label "the classical definition of truth" was invented in Poland in the 1920s and occurred in Kotarbiński 1926, pp. 120/121 for

[1] The article is a result of the project *The Significance of the Lvov-Warsaw School in European Culture*, supported by the Foundation for Polish Science. I use some material previously published in Woleński 1989, Woleński, Simons 1989 and Murawski, Woleński 2008.

[2] Bibliographical references to writings by Polish philosophers mention the year of publications. Translations into English are added in particular bibliographical items at the end of the paper.

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the first time.[3] This paper reviews aletheiology in LWS. I start with Kazimierz Twardowski, the father of the school. Then, a section on the Kotarbiński-Leśniewski debate follows. It also contains later views of both philosophers. Łukasiewicz's views are reported in the next section. Tarski's theory and its philosophical significance is briefly presented in section 5.[4] Finally, I give a general summary of aletheiology in LWS. This scheme is only a skeleton. Several contributions by other members of LWS, like Kazimierz Ajdukiewicz, Tadeusz Czeżowski, Maria Kokoszyńska or Zygmunt Zawirski are mentioned and commented on. In principle, my considerations cover the period of 1900–1939, but some later contributions of particular authors are taken into account as well.

2. Twardowski

Kazimierz Twardowski strongly influenced the subsequent aletheiology of LWS as well as many other philosophical views developed in Polish analytic philosophy. In 1900, he published an influential paper on relative truths.[5] Twardowski's problem was to answer the question of whether truth is absolute or relative. Something (a bearer of truth) is absolutely true provided that it is true everywhere, at all times and under all conditions, in particular, in all places. On the other hand, a truth-bearer *A* is relatively true, if it is true in some circumstances (at some time, at some place or under specific circumstances) and it implies that this bearer is not absolutely true. For instance, the relativists say (Twardowski's examples) that the utterance "This flower has a pleasant smell," "It is raining," "Cold baths are healthy" or "It is morally wrong to conceal the truth." Twardowski argues that these examples are mistakenly considered to express relative truths. In order to show that, he distinguished sentences (*powiedzenia* in Polish) and propositions (*sądy* in Polish).[6] According to Twardowski, sentences have no single or fixed meanings. Thus, the meaning of a given sentence can be associated with several propositions and a correlation in question can and usually does depend on various specific circumstances.

[3] In fact, Kotarbiński used the expression "the classical answer [to the problem of truth]." See also Kotarbiński 1929, p. 126, where the label "the classical understanding of truth" occurs.

[4] "Briefly" because this theory deserves an extensive elaboration. I am working on a monograph on this topic (see Woleński (in preparation)).

[5] Influential in Poland, in spite of the fact that this paper appeared in German in 1904.

[6] Twardowski's terminology was slightly different. In German, He used the word *Urteil*, which is translated as "judgment." However, he understood judgments as non-psychological entities. Hence, the term "proposition" is legitimate in the context of his examples.

Twardowski points out that the judge (the person who expresses his or her judging in a sentence) often omits some contents which he or she has in his or her mind. Such omissions do not create misunderstanding in typical situations, because people rely on contexts in question. Consequently, sentences are mostly elliptical expressions of their meaning. A person standing on the Castle Hill in Lvov at a certain time who says "It's raining" expresses a proposition which actually means (for instance) "At 12 noon, Central European time in March 1900 according to the Gregorian calendar it is raining in Lvov on the Castle Hill." Clearly, using such long sentences instead short ones is not practical and goes against the economy of spoken language. On the other hand, elliptical sentences can always be made sufficiently precise by supplementing additional co-ordinates into them. In particular, someone who utters the expression "It's raining" in Krakow on the same day, can say something false. However, these two utterances containing the same words (as types, not tokens) express two different propositions, one true, but another false.

Relativism illustrated by examples like "It's raining" can be refuted by pointing out that propositions, not sentences, are proper bearers of truth (falsity). Consequently, what can be relatively true or false are just sentences, not propositions. However, the relativity of truth (falsity) as attributed to sentences is a derivative of their elliptical character, in particular of the indexicality of some sentence-constituents. Twardowski likewise shows that the apparent relativity of locutions expressing tastes, rough generalizations, scientific hypotheses or moral rules is not based on determinate meanings. For instance, the relativity of tastes or moral evaluations stems from a lack of references of the persons who evaluate, the relativity of rough generalizations – to the phenomenon of vagueness, and the relativity of scientific hypotheses – to overlooking the difference between truth and truth-criteria.[7]

In general, according to Twardowski, every genuine, that is, propositional truth or falsehood is absolute. Clearly, the problem of the relation of truth to time (or space-time) was central for Twardowski. For him, truth and falsity, if conceived in the primary sense, are omnitemporal, that is to say, a proposition *A* is true at every time, if true and false at every time, if false. Another important observation of Twardowski points out that

[7] However, there is a problem with moral rules. Twardowski defended ethical absolutism. Thus, his treatment of moral rules as dependent on personal evaluations creates a problem for his ethical theory. I only note this question without entering into details.

aletheiological relativism violates the principle of the excluded middle and the principle of contradiction as fundamental rules of logical thinking.[8]

Twardowski did not attempt to define truth in his paper of 1900. He rather spoke about true propositions (judgments) and it was sufficient for his critical remarks against relativism. However, he did not deny that a closed analysis of the concept of truth is required. Twardowski lectured on epistemology several times. He always included a part on theories of truth in his epistemological course (one of them was published as Twardowski 1974).[9] Twardowski addressed himself to the following topics concerning truth:

(a) the correspondence theory of truth (theory of transcendent agreement);
(b) B. Russell's theory of truth;
(c) a critique of the correspondence theory of truth (of transcendent correspondence);
(d) the coherence theory of truth (the theory of immanent correspondence) and its critique);
(e) Rickert's theory of truth and its critique;
(f) pragmatism and its critique.

Generally speaking, Twardowski divided truths into two groups (it became customary in Poland):

(i) the correspondence (classical with several qualifications; see below) theory of truth;
(ii) non-classical theories ((d), (e), (f)).

He rejected pragmatism as a typical relativist approach. The coherence theory was criticized by Twardowski for its indeterminacy and, it was the strongest argument, circularity (this theory appeals to the comparability of propositions, but this property cannot be defined without invoking truth). The objection of circularity is addressed by Twardowski also against Rickert because we cannot understand the oughtness (the norm of truth) as the ultimate truth-criterion without assuming what is true. Moreover, Twardowski points out that Rickert's understanding of the transcendental is very far from being clear.[10]

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[8] Twardowski's refutation of relativisms was strongly influenced by Brentano and possibly by Bolzano. On the other hand, his arguments based on semantic and logical observations are rather novel.

[9] About 80% of the text is devoted to the concept of truth.

[10] Twardowski's criticism of Rickert is strengthened in Ajdukiewicz 1937. Roughly speaking, Ajdukiewicz points out that as transcendental norms of truth are understood as rules of

Since Twardowski followed Brentano's in accepting Aristotle's famous formula

(Ar) To say of what is that it is not, or what is not that it is, is false, while to say of what is that it is, and of what is not that it is not, is true,

as fundamental for the proper truth-theory, he (Twardowski) took Russell's ideas as representative for theories seeing the essence of truth in *adequatio*, *conformitas* or correspondence, all understood as a relation between propositions and the reality. Twardowski observed that such interpretations of (Ar) assume that we have representations of the world, express them by propositions and if representations agree with what they represent, a given proposition is true, otherwise false. However, as Twardowski argues, the relation of representation consists in faithfulness or not, but not in truth or falsity. As far as the issue concerns Russell's theory, Twardowski points out that it is based on a very peculiar and non-intuitive understanding of propositions (judgments) as having real items as their constituents. This treatment makes the concept of correspondence very non-standard. In his positive account, Twardowski continues Brentano and defines truth as affirmation or denial of the existence of a given object, provided that the idiogenic theory of judgments is assumed (judgments are not combinations of presentations as the allogenetic account says). In particular, this approach meets the objection that the correspondence theory of truth cannot be supplemented by an effective truth-criterion, because, for ontological reasons, we cannot compare representations and what corresponds to them (representations and represented objects belong to essentially different categories).

Twardowski's aletheiological ideas were continued by other representatives of LWS. His arguments against relativism were commonly shared in Polish analytic philosophy. Maria Kokoszyńska (see Kokoszyńska 1936, Kokoszyńska 1948, Kokoszyńska 1951) reformulated Twardowski's analysis of relativism in modern semantic terms. In particular, she distinguished between genuine and non-genuine relativism. She argued that relativisation of truth to languages does not lead to genuine relativism (that is, relativism in Twardowski's understanding). No member of LWS accepted the correspondence theory of truth a la Russell or considering the essence of truth as a relation between the representans and the representandum, to use labels modeled by the terms, like "definiens" and "definiendum" or "explanans" and "explanadum." On the contrary, the traditional concept of correspondence was considered to be very unclear (see Kotarbiński 1926,

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deduction, the incompleteness of mathematics shows that not all truths are deducible.

pp. 126–130, Kotarbiński 1929, p. 127).[11] Similarly, non-classical theories of truth were criticized in LWS by arguments to be found in Twardowski 1900 and Twardowski 1975 (see the mentioned works of Kotarbiński and Ajdukiewicz 1949). This does not mean that all Twardowski's views were continued by his followers. In particular, his truth definition as affirmation or denial of the existence of objects was too narrow in order to be accepted by philosophers trained in mathematical logic.

3. The Kotarbiński-Leśniewski Debate in 1913 and Their Later Views

Tadeusz Kotarbiński in his Kotarbiński (1913) is mainly concerned with the possibility of creative human action. He regards such as inconsistent with predermination and this leads him to consider the eternity and sempiternality of truth.[12] Kotarbiński employed Brentano's standard definition:

(1) A proposition (judgment) A affirming the object O is true if and only if O exists.

He also accepts

(2) For every A, if A is true at the moment t, then A is true at every t' later than t.

This means that every truth is eternal (in the sense described above). Kotarbiński denies the universality of

(3) For every A, if A is true at t, then A is true at every t' earlier than t.

Thus, (3) asserts that not all truths are both eternal and sempiternal. Consequently, due to (2) there are truths which are eternal but not sempiternal. Consider an object O such that it is created by a human action. This object does not exist until it is created and no proposition A affirms the existence of O created. But it is not so that A is false in this situation, for it were, its negation would be sempiternally true, so it would be impossible to create O, contrary to the accepted assumption. Consequently the

[11] Simons and I (see Woleński and Simons 1989) proposed the labels "strong correspondence theory" and "weak correspondence theory" in order to contrast the traditional correspondence account of truth and that developed in LWS.

[12] Kotarbiński was possibly influenced by Łukasiewicz who in a lecture in the Polish Philosophical Society in Lvov (see Łukasiewicz 1910b) noted a connection between the principle of excluded middle and radical determinism (fatalism or predetermination of human action; see Simons, Woleński 1987).

proposition *A*, as well as its negation, is not sempiternally true or false, but neither true not false at moments prior to the creation of *O*.

The admission of propositions which are neither true nor false, requires a weakening of the principle of excluded middle. Kotarbiński considers the following assertions:

(4) For any *A*, either *A* or not-*A* is true;
(5) For any *A*, *A* is either true or false;
(6) For any *A*, if *A* is true, then not-*A* is false.

It is easily to observe that (4) and (5) assume

(7) *A* is true if and only if *A* is not false.

On the other hand, (6) and (7) are mutually independent. Thus one can accept (6) and deny (7). This means admission of independent propositions, that is those that are neither true or false. Define true or false as definite, but neither true nor false as indefinite. Thus, we have

(8) For any *A*, *A* is either definite or indefinite.

This rule is universally valid, but (4) and (5) hold for definite sentences only.[13]

Kotarbiński's view was strongly criticized by Stanisław Leśniewski (see Leśniewski 1913a, Leśniewski 1913b). According to the latter, every sentence is either true or false. Leśniewski's argument for this principle (5) is based on explicit assertions concerning the concept of truth. Leśniewski assumes the following definition (as capturing Aristotle's intuition):

(9) *A* of the form '*a* is *b*' is true if and only if the object signified by the subject has the property signified by the predicate.

Putting (9) in other words, (9) asserts the relation of inherence holding between the object in question and its property. If this property is realized, *A* symbolizes something. Two further conditions must be satisfied here. Firstly, *a* cannot be an empty name and, secondly, the predicate *b* has to connote the property possessed by the referent of *a*. Now armed with these conditions, Leśniewski argues that the principle of excluded middle is false for propositions having empty subjects, because two contradictory propositions with empty subject terms are false by definition.

[13] There is a historical problem of whether Kotarbiński anticipated many-valued logic. Certainly he did not construct such a system and has no intention to do so. See Woleński 1990 for a more extensive discussion this question.

On the other hand, if one of the contradictory sentences (both with non-empty subjects and connoting predicates) is false, the second one is true. Thus, while Leśniewski rejects the universal validity of excluded middle, he denies the existence of indefinite propositions. His argument goes as follows. Assuming that that *A* is not false, it is not true as well. This means according to Leśniewski's settings that *A* fails to possess the symbolizing function; it also does not possess such a function. Leśniewski claims that this leads to a contradiction following from the initial assumption that if *A* is not true, it is also not false. Leśniewski's reasoning is not quite correct, because neither of the statements[14]:

(10) If *A* fails to possess the function of symbolizing, it does not possess such a function;
(11) If *A* does not possess the function of symbolizing, it fails to possess such a function,

is contradictory in itself. To improve the analyzed argument of Leśniewski (modulo his conventions), one must additionally assume the antecedents of (10) and (10) or (7). Since both strategies are acceptable on Leśniewski's assumptions, we can conclude that he was entitled to his rejection of indeterminate propositions.

A more interesting item is Leśniewski's proof that every truth is sempiternal. Accept the definition of sempiternality. Assume that *A* is true, but not sempiternal. Consequently we have

(12) *A* is not true (let's say), but there is moment *t* such that *A* was not true at *t*.

As the next step we have

(13) Not-*A* was true at *t*.

Using the principle of contradiction and (13), we get

(14) Not-*A* is now false.

Using the principle of contradiction once again, we obtain

(15) Not-*A* is always false.

But, due to (15), not-*A*, contrary to (13), cannot be true at *t*. Hence, we must reject the main assumption, that is, that *A* is not sempiternal. Finally, we have the desired conclusion that every truth is sempiternal.

[14] I use in this and the next sections the terms "proposition," "sentence" and "statements" as equivalents; see Rojszczak 2005 for the history of truth-bearers in LWS.

Leśniewski's proof presupposes a certain interpretation of tensed propositions and their logical values. On this view, the temporal index of a tensed sentence should be placed as a parameter concerning the subject. The sentence "Caesar will cross the Rubicon in 49 BC" and "Caesar crossed the Rubicon in 49 BC" can both be transformed into "Caesar-in-49-BC crossed the Rubicon." This sentence is timeless and can be used literally at every time. This way of treating tenses enables Leśniewski to consider the sentence "Caesar crossed the Rubicon in 49 BC" as well as the sentence "Caesar will not cross the Rubicon in 49 BC" uttered now as mutually contradictory. According to Kotarbiński, the former is definite, but the latter indefinite.[15]

Leśniewski followed Twardowski's absolutism in his considerations. He wrote (Leśniewski 1913b, p. 104; page-reference is to English translation), explicitly alluding to Kotarbiński:

> No truth can be created! The need to stress and energetically instill this view in others is growing now that, at the present stage of development of Polish 'philosophy,' voices claiming that truths are created are clamoring ever more loudly. […]. That is not only for those for whom, like for the Greek sophist Protagoras and the Polish sophist Florian Znaniecki, 'man is the measure of all things' and thus a 'measure' of truth. Slowly, truths begin to become 'created' even by the representatives of that camp which has gathered at the Lvov University around Professor Kazimierz Twardowski, that is the camp whose members have for such a long timer believed that a judgment is *always*, 'absolutely' true, that it is true independently of whether it is useful or damaging; whether it helps to forecast the future or not; whether a scholar felt like 'creating' the given truth and he did, or refrained from such 'creation,' *etc*. *No truth can be created*!

Twardowski himself joined Leśniewski's side in arguing against creating truths (see Twardowski 1971; the text was written in 1923–1924).

Kotarbiński subsequently rejected the idea of indeterminate sentences. In his later works (see Kotarbiński 1926, Kotarbiński 1929, Kotarbiński 1934; see also Hiż 1966), he defended the classical truth-definition (see note 3 above) and rejected non-classical ones, in particularly the account of truth in pragmatism. His canonical interpretation of (Ar) is captured by

(16) John thinks truly if and only if John thinks that things are so and so, and things are so and so.

The words used in (16) are not accidental. Since Kotarbiński was a reist and, thereby, a nominalist (singular or concrete things are the only existent), he wanted to have thinking persons as the bearers of truth. Hence, he

[15] Leśniewski reasoning concerning tensed sentences can be easily formulated in model-theoretic semantics (see Woleński 2015).

used "truly," not "true." This point constitutes his adverbial theory of truth (in this respect, Kotarbiński ideas were close to Brentano (see Pasquerella 1989), although probably independent). Another important aletheiological point of Kotarbiński concerned the distinction of verbal and real use of "true" or "truly." If we say

(17) It is true that Warsaw is the capital of Poland,

the prefix "it is true" can be omitted or eliminated without any changing the meaning of the sentence "Warsaw is the capital of Poland." It is just the verbal (presently the labels "redundancy theory" or "deflationary theory" are employed) use of "true." Kotarbiński baptized theories based on the verbal use of "true" as nihilist.[16] However, if we say

(18) The theory of evolution is true,

we cannot eliminate "is true." It is the real use of this prefix. Hence, "is true" does not admit elimination in the case of real use. Consequently, Kotarbiński accepted the redundancy theory with respect to the verbal use of "is true."

Remarks on truth in later (1920–1939) works of Leśniewski are fragmentary. Leśniewski effectively showed (see Leśniewski 1929) that "it is true that" can be introduced as a connective into prothotetic (the extended propositional calculus). Furthermore, Ontology (the calculus of names constructed by Leśniewski; see Leśniewski 1931) forces that the sentence "*a* is *b*" is true, provided that *a* is singular, non-empty, but *a* and *b* are co-referential. Such a sentence is false on other occasions; this means that Leśniewski rejected the idea that sentences with empty subject-terms are indefinite. Leśniewski also kept his earlier analysis of tensed sentences. In general, he defended the classical truth-definition as a weak correspondence theory (see note 11 above). The concept of truth is governed by principles of excluded middle and contradiction. Thus, Leśniewski considered classical logic as *the* logic; the conjunction of non-contradiction and excluded middle generates bivalence: every sentence is either true or false and no sentence is true and false and this principle can be formalized in protothetic. This fact alone shows that extended propositional calculus is essentially stronger than the usual one, because the latter sends the principle of bivalence to metalogic. Leśniewski also formulated several particular ideas

[16] Although Kotarbiński did not mention any philosopher defending nihilism in this sense, he could be inspired by Twardowski (recall that he identified truth and true propositions by fiat). It is rather sure that he did not know Ramsey's views. Zygmunt Zawirski (see Zawirski 1914) was another "nihilist" in Poland.

important for the semantic definition of truth. I only mention them without entering into details (I will return to these topics in section on Tarski). Leśniewski's observations are as follows: (a) we can formalize languages without resigning that their elements (words, sentences) are meaningful (intuitive formalism; Leśniewski used the adjective "intuitionistic," but it is somehow misleading); (b) semantic constructions must be formulated in a metalanguage in order to avoid semantic paradoxes, like the Liar antinomy; (c) the scheme

(T) *A* is true if and only if *A*,

plays the central role in the theory of truth.[17]

4. Łukasiewicz

Jan Łukasiewicz's first observations about the concept of truth were made in his treatise on the principle of contradiction in Aristotle (see Łukasiewicz 1910a; see also Łukasiewicz 1911). His interpretation of (Ar) is, as in the case of many Polish philosophers of that time, definitely Brentanian. He says that a sentence *A* is true if and only if it states that something exists or does not exist. More specifically, Łukasiewicz proposes:

(19) An affirmative proposition is true if and only if it ascribes a property to an object, which is possessed by this object; a negative proposition is true if and only if it rejects a property, which is not possessed by a given object.

This idea was combined by Łukasiewicz with Meinong's theory of objectives. In this approach, objectives are objects of proposition, but he, contrary to Meinong, did not characterize propositions in the logical sense as objectives. In Łukasiewicz 1920a, we find the Fregean account of truth and falsity as (written as Truth and Falsehood) objects denoted by sentences. Then, Łukasiewicz rejected this idea as too speculative and returned to understanding the concept of truth along Aristotelian lines.

In 1910 Łukasiewicz still believed in the absoluteness of truth. He radically changed his mind in 1917, when he discovered three-valued logic (see Łukasiewicz 1920a, Łukasiewicz 1920b, Łukasiewicz 1922 – Łukasiewicz's Rector Speech, Łukasiewicz 1930). Łukasiewicz divided sentences into true, false and neutral (or possible), that is having the third logical value denoted let's say by $\frac{1}{2}$. If $A = 1$ (true), not-$A = 0$ (false; if

[17] However, this scheme earlier appeared in Czeżowski 1919.

$A = 0$, not-$A = 1$; if $A = \frac{1}{2}$, not-$A = \frac{1}{2}$.[18] The third logical value is possessed by future contingents, that is, sentences about future not-necessary (and not-impossible) events. Łukasiewicz's primary motivation was deeply metaphysical. He maintained that bivalence (recall it is the conjunction of the principles of contradiction and excluded middle) together with the principle of causality, inevitably leads to radical determinism and, thereby, to fatalism.[19] Thus, in order to make freedom intelligible, Łukasiewicz proposed a revision of logic.[20] He defined truth once again in Łukasiewicz 1957 saying that truth consists in conformity of thought with today's reality. More abstractly, he accepted eternality of contingent truth as defined by (2), but rejected its sempiternality as defined by (3). In a sense, his approach can be considered as absolutistic with respect to truth and falsity, because if a sentence is true or false it remains as such for ever. On the other hand, the third logical value is not stable, that is, it can change during the course of time. This means that if *A* is true, it is not necessarily true forever. Clearly, the rejection of sempiternality leads to the rejection of bivalence. Concluding, truth and falsity are absolute, but other logical values lack this property.[21]

Another of Łukasiewicz's important contributions to aletheiology was his analysis of the Liar paradox (see Woleński 1994). He was not satisfied by a traditional account employed the sentence "I am lying now," because it contains indexicals and, thereby, is elliptical. Łukasiewicz proposed the following sentence for expressing the Liar Paradox:

(20) The sentence printed on the line *m* on the page *n* in this book is false,

where *m* and *n* exactly refer the line *m* on the page *n* of the book in which the sentence (20) is printed. The advantage of this formulation is that the occurring indexicality of (20) can be easily eliminated by deixis, contrary to the locution "I am lying now." Clearly, if (20) is true, that is, if it truly says that it is false, it is false, but if it is false, it is true. Thus, (20) if and only if not-(20), we have a contradiction. According to Łukasiewicz,

[18] More precisely, we should say "the value of $A = 1$," *etc*. The generalization to more logical values is possible, but I omit it.

[19] One should carefully observe that Łukasiewicz did not protest against logical determinism understood as a consequence of the principle of excluded middle. He rejected determinism as a consequence of bivalence (metalogically interpreted) and the principle of causality.

[20] Łukasiewicz's view has affinities with Kotarbiński's account, but there is no evidence for their mutual influences (see also note 12 above).

[21] Note that an intuitive interpretation of many-valued logic is still controversial. See Malinowski 1993 for a discussion.

the Liar sentence is ill-formed and cannot be a value of a propositional variable.[22]

5. Tarski

As I already noted, this section contains a concise elaboration of the semantic theory of truth formulated by Alfred Tarski in 1933 (see Tarski 1933, Tarski 1944, Tarski 1969). Tarski's ambition was to give a truth-definition following the Aristotelian tradition and free of the Liar paradox. This paradox strongly blocked the development of format semantics until the 1930s; the syntax-oriented approach of the Vienna Circle to logic documents this situation. Tarski, following Leśniewski, offered a diagnosis of the Liar paradox and other semantic antinomies. According to this diagnosis, paradoxes are caused by three circumstances:

(i) self-referential use of semantic predicates, in particular, the adjective "true";
(ii) the scheme (T);
(iii) the use of classical logic.

(T) was considered as the core of every reasonable truth-definition. In fact, Tarski claimed that a good truth-definition should entail all instances of (T), that is, be valid for any sentence *A*; it was the condition of material adequacy of the required definition. Secondly, this definition should be formally correct, that is, non-circular and so on and, which was particularly basic, free of contradictions, like the Liar paradox. It can be achieved, for instance, by revising logic. In more recent terminology, we can propose many-valued logic, truth-value gaps (sentences which are neither true nor false) or paraconsistencies (dialetheias), that is, sentences simultaneously true or false. However, Tarski considered revisions of logic as too expensive. If so, the only strategy to cope with semantic paradoxes consisted in excluding self-referentiality.[23] In order to do that, Tarski, once again following Leśniewski, divided language into the object language (L) and its metalanguage (ML).

Semantic concepts function in ML. Consequently, the predicate "is true" belongs to the metalanguage, but it is applied to sentences of L. This

[22] The discussion of the Liar paradox is included into Łukasiewicz 1915. It is an extended version of Łukasiewicz 1911. Unfortunately, Łukasiewicz 1970 includes the earlier version.
[23] It is an important point. Some people say that the division into L and ML is artificial. However, things appear differently if we calculate costs of possible solutions, because nothing is free of charge here.

forces a reformulation of (T) from its naïve form (as already given) to more sophisticated

(T′) n(A) is true if and only if A*,

where "n(A)" is a name of A (for instance "A") and A* is an embedding of A into ML. Such embedding can consist in translating A into ML or including this sentence into the metalanguage. (T′) is, of course, expressed in ML and A cannot contain the predicate "is true." In fact, we have an infinite hierarchy of languages H = L_0, L_1 (= ML_0), L_2 (= ML_1), …, L_n (= ML_{n-1}), …, and if we intend to formulate the truth-definition for L_n, it must be done in L_{n+1}, that is, ML_n. Consequently, we cannot expect a consistent truth definition for the entire H. Thus, truth is always relative to a language L and formulated in ML,[24] which we assume about L and ML. First of all, both languages are interpreted (compare Leśniewski's intuitive formalism; see above). Thus, it not true that Tarski's definition applies to purely formal languages. Moreover, ML must be richer than L in this sense that it has resources to define concepts used for truth-definition. Originally Tarski assumed that ML has expressions of higher syntactic categories than L, Today, it is rather taken for granted that ML possesses a sufficient amount of set theory. Anyway, considering ML as syntactic allows the avoidance of circularity.

Tarski chose an indirect route for defining truth. Firstly, he defined the concept of satisfaction. Take the expression "x is P," where x is a free variable. It is an example of an open formula (or a propositional function in older terminology). A sentence is a formula without free variables, for instance "Warsaw is the capital of Poland" or "there is x, such that x is the capital of Poland." Observe that sentences are a special case of open formulas, that is, formulas without free variables. Now, open formulas are neither true nor false, but they are satisfied or not by some objects. For instance, the formula "x is the capital of Poland" is satisfied by Warsaw, but not by Cracow. Inserting a proper name for the variable x converts the open formula in question into truth ("Warsaw is the capital of Poland") or falsehood ("Cracow is the capital of Poland"). This consideration suggests that if sentences are a special case of open formulas, truth is a special case

[24] Things look less dramatic in modern elaborations of Tarski's theory, because if we formulate it for first-order languages, it is enough to use second-order formal devices. Now the impossibility of a truth-definition for the entire H is replaced by the Tarski undefinability theorem: the set of true sentences for a theory sufficiently rich for formalizing arithmetic of natural number is not definable in this theory. It is one of the fundamental metamathematical limitative theorems. Moreover, contemporary approaches define truth for a language L and model M. See (Grzegorczyk 1974) for a detailed treatment of this line.

of satisfaction, but falsity is a special case of not-satisfaction. Since open formulas can have arbitrary but finite names of free variables, we need infinite sequences of objects. This leads to the following definition of truth;

(SDT) A sentence *A* is true if and only if it is satisfied by every infinite sequence of objects (equivalently; by the empty sequence, by some sequence).

Since (SDT) entails all instances of (T′), it is materially adequate. Its consistency depends on the expressive power of a theory *Th* for which truth is defined. If we have to work with the arithmetic of natural numbers or stronger theories, their consistency cannot be proven in them. On the other hand, we have strong empirical evidence that (SDT) does not lead to semantic paradoxes. Finally, (SDT) implies bivalence. The Tarski undefinability theorem effectively shows that semantics is richer than syntax. More specifically, while the syntax for L can be built by constructive methods, semantics cannot.

Certainly, this definition looks somehow artificial. Note, however, that bound variables have no relevance for the interpretation of sentences. Consequently, they (bound variables) do not matter whether sentences are satisfied or not. Thus, we can value bound variables by arbitrary sequences of objects, including the empty sequence. Speaking informally and employing the concept of model, the truth of sentences does not depend on valuations of free variables, but is determined by the shape of a domain in question. If we take of the set of Polish cities, their properties as well as relations between them, this domain is such that the sentence "Warsaw is the capital of Poland" is true, but the sentence "Cracow is the capital of Poland" is false. Similarly, the sentence "Cracow is smaller than Lublin" is false, but the sentence "Wrocław is larger than Katowice is true." The fact that Cracow was the capital of Poland in the 14th century does not create any problem. We can say "Cracow-of-the 14th century" was the capital of Poland and this sentence is sempiternally true. Is (SDT) a correspondence theory of truth? First of all, Tarski at the beginning considered his truth-definition as more philosophical than metamathematical. He did not realized in 1933 and even later that (SDT) constituted the core of model theory as branch of metalogic. Tarski always stressed that his formal construction used Aristotelian intuitions. In 1933 he freely used the label "agreement with reality," but in his later writings (see Tarski 1944), he observed that statements, like "correspondence with facts" or "conformity with states of affairs" are much less clear than (Ar). He also used (16) as the starting point for further considerations. To conclude, we can say that (SDT) offers a formal exposition of the concept of weak (or semantic) correspondence. Let me mention an interesting argument of Tarski's against

the nihilist (Tarski used this label) theory of truth (see Tarski 1944). Consider the metalogical principle

(21) The logical consequences of true sentences are true.

Arguably, (21) cannot be formulated in the framework of the nihilist aletheiology.[25]

6. Final Remarks

There is an explicit continuity of aletheiology in LWS from Twardowski to Tarski. Most Polish authors followed Aristotle's ideas, eventually in a Brentanist shape, accepted the weak correspondence and considered truth as absolute. (SDT) offers a very sophisticated account of these ideas. Although Łukasiewicz was an exception, he defended the eternality of truth, which can be accepted as a weakened absoluteness. Aletheiology in LWS was developed parallel to the growth of mathematical logic. Twardowski, Kotarbiński, early Leśniewski and early Łukasiewicz explained their ideas informally and with quite old-fashioned formal equipment. On the other hand, later works of Leśniewski, Łukasiewicz and, particularly Tarski, involved strong formal logical devices. And this last point is perhaps the most important Polish contribution to contemporary aletheiology.

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[25] More precisely, it can be done, but the formula is much more complicated, for instance "for every A, B and X, if $A \in X$ and A implies B, then B." However, this formula requires several additional assumptions about quantifiers and sets of true sentences.

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QUESTIONS AND COGNITION. ON EROTETIC REASONING WITH REFERENCE TO SOME AJDUKIEWICZ'S IDEAS[1]

1. Questions in Cognitive Processes

Questions – or, strictly speaking, mental states corresponding to questions – play an important role in cognitive processes and, in particular, in scientific cognition. This is why the theory of questions (*scil*. erotetics) has a lot in common with epistemology, general methodology and with methodologies of particular disciplines.

Firstly, volitional acts which express themselves in questions are 'conductors' of our cognitive operations. Secondly, questions and answers play a crucial role in the process of transmitting knowledge between people. Thirdly, questions are irreplaceable cognitive tools in some scientific disciplines (*e.g.* psychology, sociology and medicine). Fourthly, every scientific discipline may be characterized by its problems – *i.e.* the set of questions to which representatives of a given disciple try to find an answer or to which an answer has already been given in this discipline.

In my paper, I shall concentrate only on one aspect of the theory of questions, situated on the border of epistemology, methodology and formal logic, *i.e.* on the role of questions in reasoning. I shall present two ideas connecting the theory of questions with the theory of reasoning: the idea of questions conducting reasoning and the idea of erotetic reasoning, in which questions play a role of premises and conclusions.

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Both ideas have an important part of their roots in the tradition of the Lvov-Warsaw School. The idea of questions conducting reasoning was formulated by Kazimierz Ajdukiewicz (1955). The theory of erotetic inferences was developed by Andrzej Wiśniewski (1995), preceded by Tadeusz Kubiński (1970). Ajdukiewicz was one of leading figures of the school. Kubiński as a student of Maria Kokoszyńska and Wiśniewski as the student of Koj and Kubiński are sometimes counted into younger generations of this formation. In keeping with this splendid indigenous tradition, I shall propose my own proposal of how to combine the two ideas mentioned.

Before presenting details, let me recall a few important elements of the general theory of questions and the theory of reasoning which I shall use in my considerations.

2. Conceptual Scheme

2.1. *Questions and Question-States*

Let us suppose that somebody asks:

(1) Who carved the altar in the Church of Our Lady in Cracow?

Let us suppose, further, that the person posing this question does it seriously, *e.g.* it is a person who is visiting Cracow for the first time and who wants more information about the treasures of Cracow's culture. Assuming that this person is asking seriously – what can we say about the experiences of this person? What experiences, in particular, are expressed in this kind of linguistic expression? What motivates this person to ask?

The majority of question theorists agree that the mental state corresponding to a question is complex and consists of:

(a) a particular conviction (in my example – the conviction that somebody carved the altar in the Church of Our Lady);
(b) a lack of some conviction, *i.e.* ignorance with regard to something (in my example: not knowing who the sculptor was who carved the altar in the Church of Our Lady);
(c) a desire to obtain certain information (in my example: a desire to know who carved the altar).

In what follows, I shall call a state composed of these three elements "a question-state." Let me add that the sentence expressing conviction which is a cognitive component of a question-state is usually called "a supposition of a given question."

One may represent all three constituents of a question-state as follows. A person who asks a question possesses an incomplete picture of a certain situation: a picture with a gap. This incomplete picture of the given situation represents the cognitive and incognitive components of question-states. The third component of a question-state may be called a will to fill a gap in the picture of this situation (or a desire to fill a gap).

In short: questions express a desire to fill a gap in a mental picture of the world.

2.2. *Completive, Hypothetive, and Selective Questions*

There are many types of questions, and the question-states to which they correspond differ in details. The question (1) analyzed above is a completive question (*resp*. variable question). In natural language, an important role is also played by hypothetive (*resp*. polar) and selective (*resp*. alternative) questions. Consider the question:

(2) Did Veit Stoß carve the altar in the Church of Our Lady in Cracow?

In the most popular erotetic theories such questions are called "decisive" or "polar" questions. Question-states corresponding to them are described as demanding decision, whether the whole sentence presented in this question (taken without inversion) is true or false (in other words it is claimed that the epistemic gap concerns the whole situation). But some remarks by philosophers and linguists incline to accept another interpretation of questions such as (2). It is easy to notice that when we utter such a question in natural language we always (or at least often) emphasize one of its components. In the case of (2), this emphasis may look, for instance, as follows:

(3) Did VEIT STOß carve the altar in the Church of Our Lady in Cracow?
(4) Did Veit Stoß carve THE ALTAR in the Church of Our Lady in Cracow?
(5) Did Veit Stoß carve the altar in the Church of Our Lady in CRACOW?[2]

This linguistic custom is of great importance to the logical description of questions of the type (2). Every question with a distinguish component possesses its counterpart in a completive question – in particular (3) is a counterpart of (1), but (4) and (5) possess other completive counterparts.

[2] It is worth stressing that in written Armenian there exist markings of certain parts of questions which are accented: the symbol which is the Armenian equivalent of a question mark is situated by the last syllable of an accented expression. A similar custom also existed in the old Polish language.

Now, what is the difference between the sense of (1) and the sense of (3)? In my opinion, in the question-state communicated in (3) besides the will to fill a gap, there is a hypothesis of how to fill it. Asking question (3) we not only want to know who carved the altar, but we want to verify a hypothesis that it was in fact Veit Stoß. That is why I call questions (3)–(5) "hypothetive questions."

Let us finely analyze the question:

(6) Did Veit Stoß carve the altar in the Church of Our Lady in Cracow, or in Wawel Cathedral?

The question-state corresponding to (6) contains two hypotheses of how to fill a gap in the picture of a situation. The completive counterpart of (6) sounds:

(7) Which altar was carved by Veit Stoß?

Asking (6), the questioner wants to know which of the hypotheses he proposes is true. Let us call such questions "selective questions."

One needs to keep some reservations here.

Let me remind you that I have assumed that the person who asks the question is asking this question seriously, so the situation described above is a typical erotetic situation. The same reservations have to be kept in mind in the case of the above description of hypothetive and selective questions. There are many situations in which we do not ask questions seriously – in situations which are not typical. Of course, a person asking a didactic or rhetorical question does not experience a question-state composed of all the components listed above.

2.3. *Types of Reasoning*

The process of thinking is sometimes described as «passing» from one thought to another. Let us call such a passage from one thought to another "reasoning." When we pass from the thought T_1 to the thought T_2, then T_1 is the point of departure of reasoning (E), and T_2 is its target point (F).[3]

So, generally, a reasoning may be represented by the scheme '$E \perp F$.' Let me mention in passing that thoughts represented by E and F do not have to be convictional, *i.e.* they are not always accepted as truths. Both thoughts may be only supposed or assumed temporarily.

[3] The symbol "E" is an abbreviation of the Latin "exodus" (Eng. "exit"), the symbol "F" is an abbreviation of Latin "finis" (Eng. "target") and the symbol "⊥," inverted "T," is an abbreviation of the Latin "transition" (Eng. "passage").

Logicians are especially interested in those types of reasoning in which the point of departure and the target point are tied by the relation of logical consequence (or by the relation similar to the relation of logical consequence), *i.e.* they are interested in these types of reasoning in which either F is a consequence of E or F is a reason for E. If this condition is fulfilled, we say that E is a premise and F is a conclusion of a given reasoning.

Let us consider two sentences:

(8) Every baroque church is rich in stuccowork.
(9) St Ann's Church in Cracow is rich in stuccowork.

Just in case, let me add that St Ann's church in Cracow is a baroque church. As one may easily notice – on the grounds of this tacit supposition – (8) logically implies (9) and (9) follows from (8). In our mental life, it may happen that we pass from (the thought represented by) (8) to (the thought represented by) (9). In such a situation our thoughts «move» according to the direction of the relation of consequence. So we have '$E \perp F$' and simultaneously '$E \Rightarrow F$.' But it also happens that one passes from (the thought represented by) (9) to (the thought represented by) (8). In such a situation our thoughts «move» in the opposite direction. In such a situation we have the following case: '$E \perp F$,' but '$F \Rightarrow E$.'

Progressive reasoning
$\Rightarrow$
implies
$S_1 \quad \rightarrow \quad S_2$
$\Leftarrow$
Regressive reasoning

We shall say that when the direction of reasoning is supposed by the subject of this reasoning as being in line with the direction of the relation of consequence, it is progressive reasoning; if it is supposed as opposite to the direction of this relation, the reasoning is regressive.

Progressive reasoning is infallible. The fact that the conclusion follows from the premise guarantees that if the premise is true then the conclusion is also true. In the case of regressive reasoning (and also reasoning which are neither regressive nor progressive) there is no such guarantee – they are fallible reasoning.

The concept of fallible reasoning should be sharply distinguished from the concept of formal error in reasoning. When a person who prosecutes a given reasoning is convinced that it is a progressive reasoning – we shall

say that it is an intentionally progressive reasoning. But it may be the case that (against this conviction) this reasoning is not *de facto* progressive (a conclusion does not follow from a premise). When an intentionally progressive reasoning is not in fact progressive, this reasoning is burdened with a formal error.

When a person who prosecutes a certain reasoning is convinced that he passes from a initial sentence to its reason, we shall say that this person prosecutes intentionally regressive reasoning. But if this person makes a mistake and in fact this reasoning is not regressive, then we say that this person makes a formal error in reasoning.

3. Questions Which Conduct Reasoning

3.1. *The Idea of Conducting-Questions*

Let us assume that two people, *A* and *B*, accept the sentence:

(10) Every baroque church in Cracow is rich in stuccowork.

Then, person *A* passes from (10) to the sentence:

(11) Every baroque church in Europe is rich in stuccowork.

One may say that person *A* carries out a certain regressive reasoning, giving an explanation to the sentence (10).

At the same time, person *B* passes from sentence (10) to the sentence:

(12) St Ann's Church in Cracow is rich in stuccowork.

By the assumption that person *B* accepts the sentence:

(13) St Ann's Church in Cracow is a baroque church.

it can be said that person *B* infers (enthymematically) (12) from (10) (progressive reasoning).

The (classical) theory of logical consequence helps to decide which mental «passages» – made by person *A* or *B* – are correct, *i.e.* which of them lead to true conclusions, assuming that the premises are also true. But let us stress that the theory of logical consequence does not explain why people choose different directions of reasoning. Kazimierz Ajdukiewicz noticed that this strange mechanism may be explained within the conceptual scheme of the theory of questions: the direction of our thinking depends on the questions which we are trying to answer.

As we remember, the question-state contains a volitional factor which may play the role of motivation. This is the fact which justifies considering reasoning as a process conducted by a question.

We may say that person *A*, going from (10) to (11) asked himself the question:

(14) Why *q*?

or:

(15) If what then *q*?

On the other hand person *B* asked himself:

(16) Given that *p*, then what?

3.2. *Schemes of Reasoning Conducted by Questions*

In traditional schemes of reasoning one may present the content of the convictions of a person prosecuting a given reasoning, but one may not take into consideration the factor motivating this person to lead his thoughts in this rather than another direction. If we make use of a conducting-question, the traditional scheme '$E \perp F$' is enriched to the form '$E \perp$-I F'[4]: the initial sentence (premise) – conducting-question – target (final) sentence (conclusion).

Let us analyze some examples:

(17) *Premise:*
Every baroque church in Cracow is rich in stuccowork.

Conducting-question:
If what, then every baroque church in Cracow is rich in stuccowork?

Conclusion:
Because – every baroque church in Europe is rich in stuccowork.

(18) *Premise:*
Every baroque church in Cracow is rich in stuccowork.

Conducting-questions:
If every baroque church in Cracow is rich in stuccowork, then what?

Conclusion:
Then – St Ann's Church in Cracow is rich in stuccowork.

[4] The symbol 'I' is an abbreviation of Latin "interrogatio."

Let us consider the role of conducting-questions in reasoning. A question state contains a volitional component defining the direction of thinking. It seems that a conducting-question is not a step in reasoning – it is neither a premise nor a conclusion – but something which stays somehow outside the reasoning (or beyond it), only dictating its direction. The conducting-question appears at the moment in which we pass from our premise(s) to our conclusion. Thus, the role of conducting-questions is of a meta-linguistic nature.

We usually represent reasoning by putting premises one after (under) another, and separating the target sentences by a horizontal line. To represent graphically the conducting-question in reasoning I propose to place the conducting-question on the level of the line separating premises from conclusion.

(19) Every baroque church in Cracow is rich in stuccowork.

If what, then every baroque church in Cracow is rich in stuccowork?

Every baroque church in Europe is rich in stuccowork.

(20) Every baroque church in Cracow is rich in stuccowork.

If every baroque church in Cracow is rich in stuccowork, then what?

St Ann's Church in Cracow is rich in stuccowork.

We have assumed that the reasoning passing from (14) to (15) was regressive reasoning, whereas the reasoning passing from (16) to (15) was progressive. This assumption was of course motivated by the fact that (14) is implied by (15) and (15) implies (16). But it happens that people prosecute incorrect reasoning. One may imagine a situation in which somebody explains (14) by (16) and infers (15) from (14). If we use meta-linguistic characteristics of reasoning by conducting-questions, we may represent these situations precisely:

(21) Every baroque church in Cracow is rich in stuccowork.

If every baroque church in Cracow is rich in stuccowork, then what?

Every baroque church in Europe is rich in stuccowork.

(22) Every baroque church in Cracow is rich in stuccowork.

If what, then every church in Cracow is rich in stuccowork?

St Ann's Church in Cracow is rich in stuccowork.

Of course (21) would be an incorrect inference and (22) would be a very poor explanation.

3.3. *Progressive and Regressive Conducting Questions*

If we agree that all reasoning is conducted by a question, we may try to propose a classification of reasoning based on the classification of conducting-questions.

One may characterize two different types of reasoning by identifying the question conducting them.

Progressive reasoning is conducted by the question:

(23) If *p*, then what?

And regressive reasoning is conducted by a question of the form:

(24) If what, then *p*?

Thus, let us refer to the respective questions by the terms "progressive conducting-questions" and "regressive conducting-questions."

These two types of conducting-questions are only the most general types of them. Conducting-questions can be classified further, according to various principles of classification. I shall only mention two such possibilities. Firstly, one may classify conducting-questions with respect to the kind of attitude towards the known (given) situation. Secondly, one may classify conducting-questions with respect to the «size» of cognitive gap indicated in a conducting question (see also Brożek (2007)).

4. Erotetic Reasoning

4.1. *Erotetic Consequence*

We have considered above the relation between questions and «traditional» reasoning, *i.e.* reasoning in which both initial and target points are sentences (connected with one another by the relation of logical consequence). Every such reasoning is conducted by a question which determines its direction. But, at the same time, conducting-questions are not steps in reasoning itself but they serve only as its «engine».

Now we shall consider reasoning in which questions play the role of steps, *i.e.* they are premises and conclusions. This problem diametrically changes the inquiring perspective, because in this case, one may not use the traditional concept of logical consequence. If questions are steps in reasoning, we should replace this traditional concept of logical consequence

by something else. Thus, let us consider the problem of what may be an erotetic analogy of traditional inference between sentences.

The property transmitted from premises to conclusions in a traditional inference is truthfulness: if '*p*' is true and '*q*' is consequence of '*p*,' then '*q*' is also true. Theorists of questions usually assume that the equivalent of the property of truthfulness in the domain of erotetics is the property of being-properly-posed (*i.e.* having true supposition).

Let us follow this idea up and define the concept of erotetic inferences according to it. But before that, one reservation is indispensable. In classical logic this guarantee of the truthfulness of a conclusion given that the premise is true, is regulated by the concept of logical truth (*scil.* substitution of tautology). The definitions analyzed above may be equipped with a precise sense only if we have at our disposal the concepts of erotetic truth and erotetic tautology. But if we identify the concept of a properly posed question with the concept of a question possessing a true supposition, then we are able to base our definitions only on the concept of 'simple,' traditional logical truth.

Let us assign the symbol S_Q to the supposition of the question Q. We shall say that:

> The question Q asertorico-erotetically (A-E) follows from the sentence S, iff the sentence '$S \rightarrow S_Q$' is a logical truth. If Q is A-E implied by S, then S is an asertoric reason of Q, and Q is an erotetic consequence of S.

For erotetico-erotetic consequence we have:

> A question Q_2 erotetico-erotetically (E-E) follows from Q_1 iff a sentence of the form '$S_{Q_1} \rightarrow S_{Q_2}$' is a logical truth. In such a situation Q_1 is an erotetic reason of Q_2 and Q_2 is and erotetic consequence of Q_1.
>
> A question Q_2 erotetico-erotetically (E-E) follows from Q_1 and a sentence S iff a sentence of the form '$(S_{Q_1} \wedge S) \rightarrow S_{Q_2}$' is a logical truth.

Within this conceptual framework, traditional logical consequence may be called "asertorico-asertoric" consequence.

This imposes the idea that one should also introduce a concept of erotetico-asertoric (E-A) consequence, defined as follows:

> The sentence S erotetico-asertorically (E-A) follows from a question Q, iff a sentence of the form '$S_Q \rightarrow S$' is a logical truth.

In what follows, I shall not concentrate on the last concept, since I am especially interested in inferential-like connections of erotetic consequences.

In order to simplify definitions, I only mention the implications of one (asertoric or erotetic) reason. But it is easy to show that the concept of consequence from a set of sentences (*resp*. questions) may be easily constructed on the basis of the concept of consequence from one sentence (*resp*. question) – as is done in the case of traditional (A-A) consequence.

4.2. *Other Concepts of Erotetic Inferential-Like Relations*

The concept of erotetic consequence defined above may arouse some controversies. Let me mention some of them.

Firstly, eroteticians do not always identify the concept of properly posed question with the concept of a question possessing true suppositions. Sometimes a "properly posed question" is defined as a question possessing at least one accurate answer, *i.e.* an answer which is both true and direct. The problem is that these two definitions converge in some cases: not every question with a true supposition has an accurate answer. If we want to assume that the property 'transferred' in correct inferences is the property of possessing at least one accurate answer, then the appropriate relations of erotetic consequence should be defined as follows. Suppose that sentences S_1–S_k are direct answers to Q. We would say that Q asertorico-erotetically follows from the sentence S, iff a sentence of the form '$S \rightarrow (S_1 \vee S_2 \vee \ldots \vee S_k)$' is a logical truth. The concept of erotetico-erotetic consequence may be defined analogously.

Secondly, some eroteticians claim that one should add some conditions to the definition of erotetic consequence (*i.e.* to make it more restrictive). This is what Andrzej Wiśniewski (1995) does in his system of erotetic logic. I shall present his idea in short, ignoring (for brevity) his logical apparatus.

Wiśniewski's counterparts of the concept of A-E consequence are the concepts of evoking and generating questions. There are two highly important conditions which Wiśniewski puts on these relations, with no analogies in the concepts proposed by me. The question Q is evoked (*resp*. generated) by the set of sentences X, only if no direct answer to Q belongs to the set X and no direct answer to Q A-A-follows from the set X.

Such concepts are stronger than the concepts of A-E-consequence: every question which is evoked or generated from X – A-E-follows from X, but not *vice versa*: not every question which A-E-follows from X is evoked or generated by it. The conditions introduced by Wiśniewski are intuitive and make concepts of inferences between sentences and questions closer to the practice of reasoning. It is clear that if we knew the answer to a given question, then drawing this question as a consequence from our convictions would be a trivial act. But on the other hand, there are no counterparts

to Wiśniewski's conditions in the traditional theory of A-A-reasoning. It is simply a fact that the sentence "Jan Matejko was a painter" A-A-follows from the sentence "Jan Matejko was a painter," despite the fact that inferring the latter from the former seems trivial.

The situation is analogical in the case of the Wiśniewski's concept of implicating questions, which is an analogue of the concept of E-E-consequence. According to Wiśniewski, the question Q_2 is implied by the question Q_1 and the set of sentences X, iff:

(i) if Q_1 is properly posed and all sentences belonging to X are true, then Q_2 is also properly posed;
(ii) for any direct answer D to the question Q_1 there is a non-empty proper subset Y of answers to Q_2 such that if the answer D is true and all formulas of X are true, then the true and direct answer to Q_2 belongs to Y.

It is easy to notice that E-E-consequence holds even if only condition (i) is satisfied. In Wiśniewski's approach, the condition (ii) is introduced as an analogue of intuitions concerning inferences between questions. There is no doubt that if we want to fill a gap in the picture of a situation corresponding to Q_1, then the passage from Q_1 to Q_2 is not trivial only if filling a gap corresponding to Q_2 enables us to fill a gap corresponding to Q_1 or at least makes it easier.

Relations of A-E- and E-E-consequence were defined here in order to explicate the concepts of A-E- and E-E-reasoning. That is why I compared them with the concept of traditional (A-A) consequence and tried to defined them as maximally similar to this traditional concept. But I would like to stress that even if we replace the concepts of A-E- and E-E-consequence by some stronger inferential-like concepts, all further comments concerning reasoning still apply (or are valid).

4.3. *The Affinity of Inferential Relations*

Before analyzing the concept of erotetic reasoning – based on the concept of A-E- and E-E-consequence, characterized above – let us briefly discuss a few examples and some problems concerning the concepts of A-E- and E-E-consequence.

The fundamental problem concerning these concepts is the following. A properly posed question is in fact just a question which has a true supposition. So the basis of erotetic consequence is the same as the basis of 'traditional' consequence: the only difference lies in the fact that truthfulness is here transmitted not to consequents themselves but to suppositions of them.

Consider the following example of A-E (asertorico-ertoetic) inference. The sentence:

(25) In every church in Cracow there are some representations of angels and the Church of Our Lady is a church in Cracow.

A-E-implies the question:

(26) How many representations of angels are there in the Church of Our Lady in Cracow?

But (25) also implies a sentence, namely:

(27) In the Church of Our Lady in Cracow there are some representations of angels.

And it is easy to notice that (27) is a supposition of (26).
The question:

(28) How many representations of angels are there in the Church of Our Lady in Cracow?

and the sentence:

(29) The number of representations of angels in the Church of Our Lady in Cracow is twice as great as the number of representations of angels in the Franciscan Church in Cracow.

E-E implies the question:

(30) How many representations of angels are there in the Franciscan Church in Cracow?

But from the supposition of question (28) and the sentence (29) we may also infer the supposition of (30).

It seems that for every erotetic reasoning/consequence one may find an adequate asertoric consequence,and that for every set of sentences connected with a traditional (A-A) consequence relation, one may find an adequate sentence-question or question-question pair.

Let us consider the following arrangement of sentences:

(31) One of Cracow's churches was decorated by Jan Matejko.
(32) The only church decorated by Jan Matejko is situated in Cracow's market square.

From (31) and (32) there follows:

(33) A(t least one) church is situated in Cracow's market square.

But one may also consider (31) and (32) as suppositions of questions which are steps in particular erotetico-erotetic reasoning.

We have:

(34) Which of Cracow's churches was decorated by Jan Matejko?
(35) The only church decorated by Jan Matejko is situated in Cracow's market square.

And (34) and (35) erotetico-erotetically imply the question:

(36) Which churches are situated in Cracow's market square?

Bearing in mind these objections and a *sui generis* parallelism of the concepts of erotetic and asertoric inferences, let us characterize the concept of erotetic reasoning.

5. Erotetic Reasoning

5.1. *Kinds of Erotetic Reasoning*

There is no doubt that some mental processes lead to particular question-states. But if we want to construct a theory of erotetic reasoning analogous to the theory of asertoric reasoning, we have to justify the view that some ways of arriving at questions (from sentences or other questions) are correct, and others are not. The theory of asertoric reasoning possesses a normative component, and this is why we need the concept of erotetic consequence. Erotetic reasoning consists of passing from sentences to questions or from questions to questions in such a way that between the initial and target point there holds a relation of asertorico-erotetic or erotetico-erotetic consequence. An A-E- or E-E-progressive-reasoning is correct/infallible iff a conclusion follows from its premises.

Asertorico-erotetic progressive reasoning may be described as passing from sentences to questions that are (supposed to be) asertorico-erotetic consequences of these sentences. Asertorico-erotetic regressive reasoning consists of passing from questions to sentences from which they result.

In what circumstances do we prosecute such reasoning? It seems that asertorico-erotetic progressive reasoning is prosecuted by everyone for whom his belief becomes a motive for asking questions. We prosecute regressive asertorico-progressive reasoning when we guess what beliefs motivated us to put a given question (sometimes we are not aware of suppositions of our questions) or when we guess what the asertoric basis of another person's question was.

Erotetico-erotetic progressive reasoning involves passing from a given question (or, alternatively, both a question and a sentence) to another question – in accordance with the direction of the relation of erotetico-ertotetic consequence. Erotetico-erotetic regressive reasoning leads in the opposite direction. When do we prosecute such reasoning? It seems that sometimes, looking for an answer to a given question (and, usually, having some additional knowledge) we decide, firstly, to find an answer to another question, and sometimes the opposite: we guess what principal question lies behind a more detailed question asked by us or by somebody else.

5.2. *Asertoric-Erotetic Reasoning*

Let us consider the concept of asertoric-erotetic reasoning more precisely.

Let an example of such reasoning be:

(37) The stained-glass windows in the Franciscan Church in Cracow were made by a pupil of Jan Matejko.
Only two students of Jan Matejko made stained-glass windows: Józef Mehoffer and Stanisław Wyspiański.

Who made the stained-glass windows in the Franciscan Church in Cracow: Józef Mehoffer or Stanisław Wyspiański?

It is easy to notice that the truthfulness of the premises guarantees that erotetic consequence is a properly posed question. Let us now recall that the concept of A-E-consequence is a parallel of the concept of A-A-consequence. The premises of the reasoning (37) may lead to an asertoric conclusion:

(38) The stained-glass windows in the Franciscan church in Cracow were made by a pupil of Jan Matejko.
Only two students of Jan Matejko made stained-glass windows: Józef Mehoffer and Stanisław Wyspiański

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The stained-glass in the Franciscan church in Cracow was made by Józef Mehoffer or Stanisław Wyspiański.

The sentence which forms the conclusion in this reasoning is a presupposition of the conclusion in reasoning (37).

Moreover, also the following A-A-reasoning is correct:

(39) The stained-glass in the Franciscan Church in Cracow was made by Józef Mehoffer or Stanisław Wyspiański.

Who made the stained-glass windows in the Franciscan church in Cracow: Józef Mehoffer or Stanisław Wyspiański?

Generally, it seems that if *Q* is A-E-implied by *S*, then *Q* is implied by every set of sentences which A-E-implies *S*.

The question arises (so, in other words, the following question is an erotetic conclusion of my considerations): When do we arrive at an erotetic conclusion rather than at an asertoric one? It seems that the mechanism for choosing this or that conclusion cannot be represented logically. In the area of logic, we are also not able to answer the question of why some people infer sentences from some sentences and other people infer questions. There is no obligation to conclude this rather than other conclusion from given premises. The theory of reasoning may only list the criteria which help to establish which conclusions – both: asertoric and erotetic – can be drawn by us from given premises correctly, *i.e.* without the risk of arriving at a false or improperly posed 'conclusion.'

It is possible that in order to arrive at an erotetic rather than asertoric conclusion one needs something which can be called an 'erotetic flash' or (put more simply) curiosity – the will to achieve a definite goal. But in fact this erotetic flash is not contained in the asertoric premises – and an old rule states that what is not contained in premises cannot be contained in the conclusion.

5.3. *Erotetic-Erotetic Reasoning*

It seems that the problem of «erotetic flash» does not arise in the case of E-E-reasoning. In this reasoning, we move from questions (or both questions and sentences) to other questions. So, since there are questions in the premises, «erotetic flash» is already contained in the point of departure of the reasoning, and it may also be naturally contained in its conclusion.

Let us consider the set of sentences *S*, and the set *S′* containing every element of *S* and, additionally, a certain other question. According to the traditional theory of reasoning (I mean the theory of asertoric reasoning) one may conclude nothing more from *S′* than from *S*. But, on the basis of the theory of erotetic reasoning, one may conclude something more from *S′* than from *S* – namely a new question.

Let us look at an example. We assume that person *A* experiences a question-state which is the mental correlate of a question:

(40) Who designed the stained-glass windows in Wawel Cathedral?

At the same time, this person knows that:

(41) The stained glass windows in Wawel Cathedral was designed by the best pupil of Jan Matejko.

A natural conclusion of the question state mentioned in connection with such a belief is another question-state, being a mental correlate of the question:

(42) Who was the best pupil of Jan Matejko?

Thus, the whole reasoning possesses the following scheme

(43) Who designed the stained-glass windows in Wawel Cathedral?
A project of stained-glass windows in Wawel Cathedral was designed by the best pupil of Jan Matejko.

———————————————————————————

Who was the best pupil of Jan Matejko?

The question (42) is an E-E-consequence of the question (40) and the sentence (41).

The most natural progressive E-E-reasoning is reasoning where a direct answer to an erotetic conclusion brings us closer to the answer to the initial question.

5.4. *Fallible and Infallible Erotetic Reasoning*

Erotetic reasoning is infallible iff the conclusion A-E- or E-E-follows from premise(s); in other cases it is fallible.

The selective question:

(44) Who designed the stained-glass window in Franciscan Church in Cracow: Józef Mehoffer or Stanisław Wyspiański?

A-E-follows from sentences:

(45) The person who designed the stained glasses in Franciscan Church in Cracow was a student of Jan Matejko.
(46) Only two students of Jan Matejko designed stained-glass windows: Józef Mehoffer and Stanisław Wyspiański.

But the question:

(47) Who designed the stained-glass window in Franciscan Church in Cracow: Józef Mehoffer or Jacek Malczewski?

does not follow from (45) and (46). Thus a person who infers (47) from (45) and (46) has prosecuted fallible reasoning.

Similarly as in the case of A-A-reasoning, one should distinguish the concept of fallibleness of reasoning from the concept of formal error in reasoning. We pass from premises to conclusion erroneously if we believe that the conclusion follows from the premises but in fact it does not.

6. Questions Which Conduct Erotetic Reasoning

Let us come back again to the problem of what decides whether we draw an erotetic conclusion (*i.e.* a question), or an asertoric conclusion (*i.e.* a sentence) from given premises. I have tried to justify the view that reasoning is conducted by special volitional experiences which may be expressed by conducting-questions. It also seems that erotetic reasoning is conducted by special volitional experiences which may be expressed by special conducting-questions.

Let us assume that person *A* from premises:

(48) Bishop Stanisław was murdered by one of the Polish kings.
(49) The murderer of Bishop Stanisław was chased away from Cracow.

concludes:

(50) One Polish king was chased away from Cracow.

On the other hand, person *B* concludes from the same premises (48) and (49):

(51) Which Polish king was chased away from Cracow?

Both types of reasoning are progressive, but they are based on two different concepts of consequence: A-E and E-E. So, the question directing both these types of reasoning should take the form:

(52) If *p*, then what [else]?

But the word "what" has to have different senses in each case, since *A* arrives at asertoric, whereas *B* at eroteric conclusion.

My suggestion is – to agree that in the first case the question directing asertoric reasoning has the form:

(53) If I know [*p*], then what [else] do I know?

when '[*p*]' is the name of an adequate proposition ("that *p*").[5] For instance:

[5] For details – see Brożek (2011), chapter 6.

(54) Bishop Stanisław was murdered by a Polish king.
The murderer of Bishop Stanisław was chased away from Cracow.

If I know that bishop Stanisław was murdered by one of Polish kings and that the murderer of Bishop Stanisław was chased away from Cracow, then [*else*] *what do I know*?

A Polish king was chased away from Cracow.

And in the second case, the conducting-question has the form:

(55) If I know [*p*], then what [else] do I want to know?

For instance:

(56) Bishop Stanisław was murdered by a Polish king.
The murderer of Bishop Stanisław was chased away from Cracow.

If I know that bishop Stanisaw was murdered by a Polish king and that the murderer of Bishop Stanisław was chased away from Cracow, then what [*else*] *do I want to know*?

Which Polish king was chased away from Cracow?

Let us finally consider E-E-reasoning. It is easy to guess that this is directed by questions such as:

(57) If I want to know [*q*] and I know [*p*], then what [else] do I want to know?

where "[*q*]" is the name of an adequate question-state. For instance:

(58) Which Polish king murdered Bishop Stanisław?
The murderer of Bishop Stanisław was chased away from Cracow.

If I want to know which Polish king murdered Bishop Stanisław and I know that the murderer of Bishop Stanislaw was chased away from Cracow, then what [*else*] *do I want to know*?

Which Polish king was chased away from Cracow?

As we can see, the cost of generalizing the concept of conducting-question consists of the cognitive relativization («cognitivization») of questions directing reasoning (including asertoric reasoning). The individual steps of reasoning (premises and conclusions) are represented in the object language. But in conducting-questions, there appears the subject who prosecutes reasoning: a subject which possesses some beliefs and desires to expand his knowledge.

Unfortunately, naturally sounding questions cannot be formulated to direct regressive reasoning.

In the table below I have compiled schemes of questions which direct traditional and erotetic reasoning. Questions which conduct reasoning concern the motivation-relation between the two experiences, expressed in the antecedent and consequent. For the aforementioned reasons, there appear in this questions expressions such as "I can" and "I should," which are to be understood as "I can on the basis of appropriate rules," "I should on the basis of appropriate rules." Since I am not sure which of these modal expressions should occur in directing questions, I give them both. My preferences are mirrored by the order in which they occur.

Reasoning	**Progressive**	**Regressive**
A-A	If I accept the sentence '*p*' as a truth, then what [other] sentence can I /should I accept as a truth?	If I accept what sentence as a truth, then I can/I should accept the sentence '*p*' as a truth?
A-E	If I accept the sentence '*p*' as a truth, then what question can I /should I ask?	If I accept what sentence as a truth, then I can/I should put the question '*q*'?
E-A	If I want to know the answer to the question '*q*,' then what sentence can I/ should I accept as a truth?	If to what question do I want to know the answer, then I can/I should accept the sentence '*p*' as a truth?
E-E	If I want to know the answer to the question '*q*' [and I accept the sentence '*p*' as a truth], then what [other] question should I ask?	If I want to know the answer to what question (and what sentence I accept as a truth), then I can/I should ask the question '*q*'?

Among the criteria for the correctness of scientific terminology, there are criterion of specification, of economy and of completeness (see Brożek (2006)). In the article "Classification of reasoning," one of main sources of the ideas presented here, Kazimierz Ajdukiewicz writes about the first two criteria.[6] My aim was to make the methodological terminology more complete, making it fulfill the latter criterion. I did not want to discard any important concepts and I did not want to make any terms

[6] See: K. Ajdukiewicz (1955).

ambiguous. I was interested in filling a gap in the conceptual scheme of the theory of questions and the theory of reasoning.

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Alicja Chybińska

KAZIMIERZ AJDUKIEWICZ ON SEMIOTIC DEFECTS[1]

The aim of this paper is firstly, to reconstruct Ajdukiewicz's understanding of the logical correctness of expressions and utterances and secondly, to show how he used the notion of semiotic defect to analyse philosophical problems.

I will begin by introducing the conceptual apparatus adopted in the article. First of all, I will explain the concept of semiotic defect. Secondly, I will reconstruct two accounts of semiotic defects which may be found in *Pragmatic Logic* (Ajdukiewicz 1974)[2] and *Zarys logiki* [*The Outline of Logic*] (Ajdukiewicz 1953). Although Ajdukiewicz did not use the very *term* "semiotic defect," he dealt with the problem of the logical correctness of expressions and utterances, as well as with semiotic defects which influence that correctness.[3] Finally, I will show how he used the method of detecting and eliminating semiotic defects in his philosophical analyses.

Whenever possible, I shall refer to the published translations of Ajdukiewicz's works, collected in *Pragmatic Logic* (Ajdukiewicz 1974) and *Scientific World-Perspective and Other Essays* (Ajdukiewicz 1978).[4]

[1] The article is a result of the project "The Significance of the Lvov-Warsaw School in European Culture," supported by the Foundation for Polish Science.

[2] The Polish version of this book is *Logika pragmatyczna* (Ajdukiewicz 1965).

[3] Ajdukiewicz's well-known theory of categorial grammar will not be discussed in this connection.

[4] This book is a selection of essays published in two volumes of *Język i poznanie* [*Language and Knowledge*] (Ajdukiewicz 1985).

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1. Introduction: The Notion of Semiotic Defect

I assume – after Jacek Jadacki (2010), who introduced a synthetic classification of semiotic defects – that an expression *E* of the type *T* has a semiotic defect, or is defective, when *E* deviates from the norm *N* which is set for expressions of the type *T*. Such a deviation may concern both semantic and syntactic aspects of these expressions – both the meaning and the structure of an expression can be defective. Accordingly, there are semantic and syntactic defects of expressions.

Semantic and syntactic defects may be further divided according to the reason why an expression is defective. According to Jadacki, an expression may be defective because of (1) the *lack* of some structural element or some "part" of the meaning, (2) the *addition* of some elements/parts, (3) the *instability* of some elements/parts, or (4) the *dissonance* between some elements/parts. I will only focus on selected types of defects here.

An example of a syntactic defect which consists in the lack of some elements is an *elliptical* (*incomplete*) expression, or *ellipsis*. In an elliptical expression some word or words are omitted, which may make the whole expression incomprehensible. This is the case of:

(1) John and his went for a walk.

Yet elliptical expressions may not seem to be defective at first glance. The sentence:

(2) Dogs like walking.

is comprehensible and looks like a correct sentence. Still, it is defected: there is no quantifier or other word which would specify which dogs – all of them or just some of them – are meant.

A type of syntactic defect which involves dissonance in the grammatical category of some elements is called a *nonsense*. Nonsenses are usually hardly understandable; they include, for instance, expressions containing a noun instead of a verb:

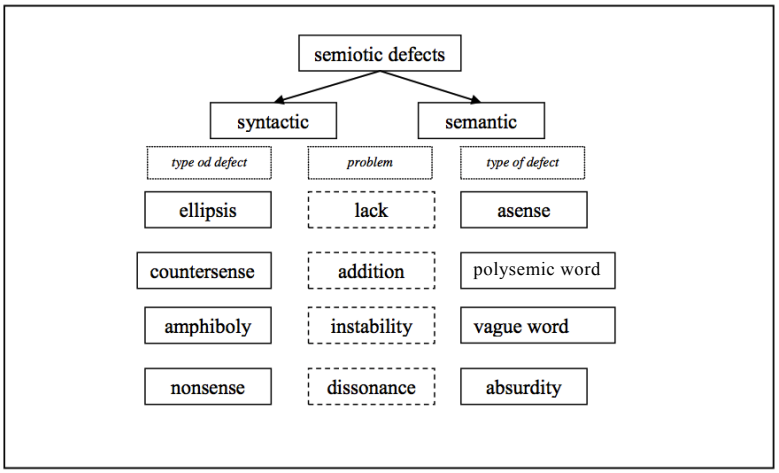
(3) Oh no, this mountain lion is going to dog me.

As far as semantic defects are concerned, when an expression has an additional denotation or connotation, it suffers from the defect of polysemy. In Jadacki's terminology, polysemic expressions include homonyms (such as "bank").

An example of an *absurdity* – which is a semantic defect that consists in the dissonance of some parts of the meaning – is the expression "old teenager," provided that we understand "teenager" in the literal sense, according to which it connotes the property of being young (we cannot think

about a teenager, *i.e.* a young person, who would be old); then, the connotation of "old teenager" consists of contradictory features, and in this sense it is dissonant and defective.

Jadacki's classification of semiotic defects is presented in the figure below.



Jadacki's (2010) classification of defects

It is clear that an expression may be defective either because of a mistake made by a language user or due to some intrinsic feature of the expression. Some defects are caused by the improper action of a language user: it is the speaker who produces elliptical sentences or who is responsible for an absurdity in the utterance. Therefore, some semiotic defects are errors.

On the other hand, some defects seem to be independent from any actions of language users. For example, if a term is polysemic or vague, the speaker can at least try to improve it by formulating a precise definition of that term; yet the very vagueness seems to be a feature of the expression. Therefore, some defects result from the language itself and are features of that language, or rather – its faults.

2. Ajdukiewicz's Classifications of the Incorrectness of Utterances

Ajdukiewicz systematically discussed the issue of the incorrectness of utterances in two works – *Pragmatic Logic* and *The Outline of Logic*. The

types and examples of incorrect expressions are similar in both books. The main difference consists in labels given to those types and, more importantly, in the general attitude to semiotic defects.

In *The Outline of Logic* Ajdukiewicz discussed (language users') *errors* of expressing thoughts or ideas, whereas in *Pragmatic Logic* he differentiated between *errors* (made by a language user) and the *faults* of language, which do not result from a speaker's activity. Since this division into features of language and errors is important for my discussion, I will begin by presenting the ideas formulated by Ajdukiewicz in *Pragmatic Logic.* Then I will briefly return to *The Outline of Logic*.

2.1. *Pragmatic Logic – Ambiguity, Semantic Defects, and Errors*

In *Pragmatic Logic*, Ajdukiewicz discussed the problem of the ambiguity of expressions, defects of meaning, such as vagueness, and errors made by language users. While defects are faults of a language, errors result from actions of language users.

Let us begin with ambiguity. Firstly, Ajdukiewicz distinguishes four types of ambiguity: (a) extension, (b) intension, (c) attitude, and (d) emotional flavour (Ajdukiewicz 1974, p. 49). An expression which is ambiguous in extension is always ambiguous in intension too; an example is "bishop," which may mean (A) a church dignitary and (B) a chessman. On the other hand, some expressions are ambiguous in intension in spite of being coextensive.

The property of being ambiguous in attitude means that one may adopt different attitudes – that of statement, question, or order – toward one and the same state of affairs. For instance, one may utter a sentence which seems to be a question but is actually an order: parents may "ask" a child to stop making noise but in fact they demand that the child stop crying. Finally, when an expression is ambiguous in emotional flavour, it may be uttered in many ways, each of which expresses different feelings.

Ajdukiewicz observes that some expressions are ambiguous in multiple respects at the same time. For example, the word "fellow," when used in the following sentences:

(4) He is a fellow of the Royal Academy.
(5) A fellow accosted me in the street.

is ambiguous in three aspects: as to its extension, intension, and emotional flavour.

Ajdukiewicz enumerated special types of ambiguity as to extension (and, consequently, as to intension). Firstly, he noticed that every word and every expression in spoken language is ambiguous: it can be used in

first-order language, and refer to non-linguistic objects, or in second-order language, or meta-language, and refer to linguistic entities. We may say:

(6) Carnap has six daughters.
(7) "Carnap" has six letters.

and refer to a real person in (6) and to a name in (7). In written language, it does not lead to ambiguity: terms of meta-language are indicated by the use of quotation marks. However, quotation marks are not visible in spoken language, which may result in ambiguity.

Another type of extension–intension ambiguity consist of indexical expressions, that is, expressions which change their meaning according to the circumstances in which they are used; they include personal and other pronouns, words of time and place, and so on.

All sentences which contain ambiguous words or expressions are ambiguous as well. Furthermore, sentences may be extension–intension ambiguous due to the fact that the syntactical relationships between their elements lead to different interpretations of the whole sentence. Examples given by Ajdukiewicz (the first one after Chomsky) are:

(8) They are flying planes.

or predictions given by ancient oracles, such as "*ibis redibis non morieris*." The latter are called amphibologies (amphibolies).

As for the defects of meaning, Ajdukiewicz focuses on vagueness. Vagueness is a feature of expressions and is caused by an incomplete process of assigning designata (referents) to a term; as a result, certain objects are clearly designated (denoted) by the term, certain objects are not, but some objects may or may not be designated by the name. An example is the word "young"; persons who are seventeen or eighteen can be treated as objects designated by "young"; persons who are two or ninety-two cannot. But it is hard to judge whether a person of thirty or forty is young or not. The same concerns the term "water": Ajdukiewicz is thinking about the boundary between a liquid which may be called "water" and a liquid which should rather be called "mud." Another group of vague terms are words which make language users embarrassed as regards their meanings; Ajdukiewicz lists such words as "to love," "to offend," or "to know" (Ajdukiewicz 1974, p. 55).

Ambiguous and vague words make statements in which they appear *undecidable*. What is important, such a fault of words and statements does not result from "our insufficient knowledge or limited power of reasoning" (Ajdukiewicz 1974, p. 55) but rather from mere ambiguity and vagueness of the terms. It is not a language user who is responsible for such features of a language.

By contrast, there are also errors made by language users. In *Pragmatic Logic* Ajdukiewicz called them "incomplete formulations," that is – elliptical utterances. According to Ajdukiewicz, incomplete formulation is not a defect of language but rather a defect of the practical *use* of language (Ajdukiewicz 1974, p. 56).

The error of incomplete or elliptical formulation consists in the lack of some essential element of a sentence. For example, the sentence:

(9) Italians are hot tempered.

is incomplete because there is one essential element omitted: we do not know whether the sentence concerns all Italians, a majority of them, or just some of them.

Other incomplete sentences are:

(10) One should eat a lot of fruit,
(11) (Something is) prohibited by law.

In (10) it is unclear, for example, which fruits are in question or for whom eating fruit is beneficial. As to (11), one may doubt which "law" is meant by the speaker.

If a sentence is incomplete, it actually has no truth value. It becomes true or false once the skipped elements are added.

2.2. *Errors of Expressing Thoughts*

Earlier, in *The Outline of Logic* (1953), Ajdukiewicz made a classification of *errors* which occur in the process of expressing one's thoughts.

Such errors include: the use of ambiguous words and sentences, the use of indexical sentences and amphibolies, confusing words used in first-order language with the terms of meta-language, and the use of vague terms.

Apart from that, there is a wide range of other errors which are closely connected with the use of language. There are: (a) using words which are incomprehensible from the point of view of the recipient of the message; (b) formulating utterances in a chaotic way, and (c) expressing one's ideas in an unclear way. The last mistake may consist in (c1) uttering elliptical sentences or (c2) choosing words which do not express the intended ideas in the most adequate way.

3. Comments

In this section I will discuss Ajdukiewicz's idea that it is not a language user but the language itself that is responsible for some defects of expressions (3.1) and then offer some comments on his understanding of ambiguity (3.2).

3.1. *Language or Language Users?*

As we have seen, in *Pragmatic Logic,* Ajdukiewicz differentiated between (a) defects or faults of language, which are features of expressions, and (b) errors, which are made by language users. The reason for the ambiguity of an expression – or at least for the extension–intension ambiguity – is that language "is not univocal in assigning meanings to expressions"; vagueness, in turn, "is a defect of meaning which an expression has in language if no extension is assigned to a term" (Ajdukiewicz 1974, p. 56).

Such an approach might suggest that language plays an active role: it is the language that is responsible for faults of expressions. However, could language itself be literally responsible for anything? This claim should be understood metaphorically: it is not a language or a custom but rather language users who undertake actions such as assigning meanings to terms. Custom is a result of certain actions (conventional acts) as well; or perhaps it *is* an action (convention): it is being continuously established and fulfilled by a given community.

Admittedly, language is often understood as a set of simple expressions, rules of forming sentences, and rules of ascribing meanings to terms. Yet this set is a result of human activity: rules were established at some point and then followed. If so, it would appear that many more defects depend on the *use* of language rather than on intrinsic features of language.

On the other hand, one has to differentiate between the time when a given language is *being* formed and the time when the language is already formed (and is being used in the strict sense). The former covers, among others, the period when meanings are *being* ascribed to the terms, whereas in the second period we have a complete set of terms and their meanings at our disposal. Language users who acquire a given language in the second period – that is, people who deal with a "ready-made" language, or with a ready-made set of terms plus meanings – treat it as a final product (putting aside minor "evolutional" changes which are present in any human language).

If one accepts this distinction, there could indeed be some faults of language which make expressions defective – ambiguous or vague. Still, it is not the *language* that causes – in the literal sense – defects of expressions.

3.2. *Ambiguity*

Clearly, the ambiguity of expressions was a serious problem for Ajdukiewicz; it is included, either as a defect of language or as an error, in both classifications presented above. It is also ambiguity that leads to numerous philosophical difficulties which shall be discussed in the next section. However, Ajdukiewicz did not consider ambiguity to be the most "dangerous" semiotic defect.

He admitted that the ambiguity of expressions is always "dangerous" but not always to the same extent. He claimed that one should avoid employing ambiguous terms or formulating ambiguous sentences if they may result in misunderstanding. However, if there is no risk of misunderstanding or misinterpreting one's utterance, there is also no point in trying to eliminate ambiguous expressions. Moreover, in such cases, the unnecessary elimination of ambiguous expressions is regarded by him as pedantry.

One may wonder when there is no such risk. According to Ajdukiewicz, such a situation takes place, for example, when the speaker knows the context of the expression. If one hears a sentence:

(12) A bishop is saying mass.

or even a more neutral one:

(13) A bishop will visit us tomorrow.

it is unlikely that they will think about a chess figure; artefacts can neither say masses nor visit anyone.

If we put it this way and agree that one's knowledge of the context seriously decreases the risk of misunderstanding, a high number of ambiguous expressions will become "not seriously" dangerous. Thus one may doubt whether ambiguity is actually a serious defect of expressions.

Secondly, the criterion of evaluating a given expression as seriously or not seriously ambiguous is not clear. A claim that the ambiguity of expressions is more or less severe would suggest that it is related to a division into scientific and everyday language; the former would be the one in which ambiguity is more serious, whereas the latter would have some tolerance for ambiguous words.

However, Ajdukiewicz did not refer to such a division. He just claimed that ambiguity is "dangerous" insofar as it results in misunderstanding. However, expressions can be misunderstood both in scientific and ordinary language. That should imply that ambiguity is "allowed" in scientific language provided that it does not lead to misunderstanding. It is difficult to guess whether this was Ajdukiewicz's intention. He might have assumed that every ambiguous expression of scientific language results in misunderstanding – and therefore that no ambiguous expression is allowed in scientific language.

A related problem regarding scientific language stems from the fact that ideas formulated in it are not always put in context. Therefore, if one cannot supply an ambiguous expression with context, it is hard to judge when an ambiguous expression leads to misunderstanding and when it does not. Admittedly, Ajdukiewicz was right in his claim that context is helpful in everyday communication and that thanks to context, ambiguous expressions become understandable. However, in scientific language the role of context is not so powerful.

To sum up the second problem: the notion of misunderstanding (of an expression or of an utterance) is crucial for grasping Ajdukiewicz's idea of ambiguity. If an ambiguous expression leads to misunderstanding, it is dangerous, undesirable, and not to be allowed – at least in scientific language.

It seems that Ajdukiewicz understood ambiguity in the following way:

(14) An expression E is (seriously) ambiguous if the use of E results in misunderstanding.

Let us assume that by misunderstanding Ajdukiewicz meant an actual misinterpretation of a *message* given by one person to another. Then misunderstanding seems to occur in a situation in which there are two or even more different senses corresponding to one message (instead of a simple pair consisting of one linguistic item and one sense). If an expression is univocal, the sense given to the expression/message by its author, the sense given to it by the recipient, and its "objective" linguistic meaning – are the same. In the situation of ambiguity there would be no agreement between these three senses.

If we label the linguistic meaning of the expression "informational sense" (S), the sense given by the author of the message – "intentional sense" (S_1), and the sense given by the recipient of the message – "interpretational sense" (S_2) (after Brożek 2010), we can define ambiguity by means of the notion of misunderstanding in the following way:

(15) An expression E is (seriously) ambiguous when it leads to misunderstanding.

(16) An expression E which is a part of an utterance U formulated by a person P_1 and addressed to a person P_2 leads to misunderstanding when:
   (i) P_1 utters E as a part of U with intentional sense S_1, and
   (ii) P_2 interprets E as a part of U with interpretational sense S_2, and
   (iii) S_1 and S_2 are not the same.

Of course, it does not work the other way round. Misunderstanding may be caused not only by the ambiguity of expressions but also, for example, by the fact that two people who are communicating with each other speak different languages.

Thirdly, Ajdukiewicz observed that one type of ambiguity is inevitably present in spoken language: it is the ambiguity as to extension–intension, or the one which consists in confusing expressions referring to objects with expressions referring to language, *i.e.* metalinguistic expressions. In spoken language, quotation marks are not indicated.

However, one may doubt whether this is actually a problem. Admittedly, quotation marks are not indicated in spoken language. Yet expressions are made univocal by context. Linguistic contexts, or sentences, in which one uses a word in order to refer to a linguistic entity, such as:

(17) "Justice" starts with "j."
(18) "Justice" has seven letters.
(19) "Justice" is a noun.

are unlikely to be confused with contexts, or sentences, in which one uses a word to refer to extra-linguistic objects, *e.g.*:

(20) Justice is a virtue.

Admittedly, there are some cases when the very context may not let one determine the reference of the word. An example is a pair:

(21) Cash is short.
(22) "Cash" is short.

However, such cases are rare and thus can be treated as exceptions rather than serious counterexamples. Moreover, sentences like (22) are elliptical or incomplete. In its full form, (22) amounts to:

(22′) The word "cash" is short.

4. Application of the Method of Detecting Semiotic Defects

In this section, I will discuss the applications of the method of detecting semiotic defects. Ajdukiewicz used this method to detect and analyse some logical and philosophical problems.

4.1. *Incompleteness and Ambiguity of Intensional Sentences*

In the article *Pewna metoda eliminacji intensjonalnych zdań i formuł zdaniowych* [*On a Certain Method of the Elimination of Intensional Sentences and Propositional Formulas*] (Ajdukiewicz 1961/1985[5]), Ajdukiewicz presented a method of paraphrasing intensional sentences which results in their "deintensionalization." Here, I will focus on his claim that some allegedly intensional sentences are incomplete, or elliptical, and ambiguous.

Let us analyse the following sentence:

(23) Caesar knew that the capital of the Republic lay on the Tiber.

It may seem that (23) is intensional (referentially opaque): when we substitute the name (description) "the capital of the Republic" with a coextensive one, *e.g.* "the capital of the Popes," we obtain the sentence:

(24) Caesar knew that the capital of the Popes lay on the Tiber.

but it is natural to assume that (23) and (24) differ in truth value – (23) is true, while (24) is false: Caesar knew nothing about the Popes.

However, Ajdukiewicz suggested that (23) and (24) are in fact elliptical and ambiguous. The first one may be completed with omitted elements and formulated as (23A) or (23B):

(23A) Caesar – *knew that the capital of the Republic lay on the Tiber* – about THE CAPITAL OF THE REPUBLIC, about the relation of lying on something, and about the Tiber,

(23B) Caesar – *knew that the capital of the Republic lay on the Tiber* – about THE CAPITAL about THE REPUBLIC, about the relation of lying on something, and about the Tiber.

Parts of (23A) and (23B) indicated by italics are the main functors (operators) of these sentences. In (23A) there is one sentence-making functor and four name-arguments. In (23B) there is one sentence-making functor and five name-arguments.

The same analysis applies to sentence (24). It may be completed in two ways:

(24A) Caesar – *knew that the capital of the Popes lay on the Tiber* – about THE CAPITAL OF THE POPES, about the relation of lying on something and about the Tiber,

[5] This text has not been translated into English. A similar text which has been translated is Ajdukiewicz 1967/1978.

(24B) Caesar – *knew that the capital of the Popes lay on the Tiber* – about THE CAPITAL, about THE POPES, about the relation of lying on something and about the Tiber.

Both (23) and (24) are thus elliptical and need to be completed. The point is that both ways of completing them – either (23A) and (24A), or (23B) and (24B) – are allowed. However, the pair of sentences (23A) and (24A) differs significantly from (23B)–(24B): one may claim that (23) and (24) contain coextensive names (and, therefore, the substitution of these names leads to a change of the truth value) only when (23) and (24) are paraphrased as (23A) and (24A).

By contrast, once we paraphrase (23) and (24) as (23B) and (24B), there are no coextensive names which could be substituted for each other. For although the names "the capital of the Republic" and "the capital of the Popes" are coextensive, the names "the Republic" and "the Popes" are not. Since (24B) is not a modification of (23B) that would consist in substituting coextensive names and result in a change of the truth value, we cannot conclude that (23B) is intensional. As a consequence, the original sentence (23) should not be regarded as intensional either. It is enough to insist that (23B) is the proper analysis of (23).

Thus, by detecting ellipsis and ambiguity we are able to reject the alleged intensionality of at least some sentences.

4.2. *Elliptical Didactic Questions*

Among elliptical expressions, there are, according to Ajdukiewicz (1934/1938/1978[6]), didactic questions. A didactic question is a question which is not asked seriously, that is, in order to acquire knowledge. Its aim is to test the knowledge of a person who is supposed to answer it.

Didactic questions have a form of standard, "serious" questions. Ajdukiewicz's example is:

(25) Who succeeded Kazimierz the Great as the king of Poland?

According to Ajdukiewicz, (25) is elliptical: there are some omitted elements. If (25) is didactic in character, then the person asking it does something more than just asking this question: that person expresses at the same time an order or a request. In fact, in order to make the speaker's intention explicit, (25) should be completed in one the following ways:

(25A) Tell me who succeeded Kazimierz the Great as the king of Poland,

[6] Polish version of this text is *Zdania pytajne* (Ajdukiewicz 1938/1985).

(25B) Do you know who succeeded Kazimierz the Great as the king of Poland? (Ajdukiewicz 1934/1938/1978, p. 163).

The first consequence of recognizing that didactic questions are often elliptical and completing them is that they become univocal. An elliptical question can be interpreted in at least two ways. In the case of (25), one could get the wrong impression that the speaker wants to get some information about the history of Poland. However, once one detects ellipsis in (25) and fills it in, it becomes clear that the speaker is not interested in the history of Poland but rather in the knowledge of the person being asked.

The second consequence of treating didactic questions as elliptical consists in a change of the type of such questions. Let me recall that Ajdukiewicz introduced the division of questions, or interrogative sentences, into (a) *decision* questions and (b) *complementation* questions (Ajdukiewicz 1934/1938/1978, p. 158). Decision questions (yes–no questions) consist of the interrogative particle and a complete sentence in the logical sense (in some languages, *e.g.* in English, they are also formed by a change of the order of elements or a sentence):

(26) Does the sun shine?
(27) Are whales fish?

What is special about decision questions is that they have only two proper answers which are mutually contradictory sentences (Ajdukiewicz 1934/1938/1978, p. 158). In the case of (27) the answers are:

(28) Yes, whales are fish.
(29) No, whales are not fish.

Other interrogative sentences, such as:

(30) Who discovered America?
(31) How do these lamps shine?

are called complementation questions. Of course, the range of possible answers is here much wider than in the previous case.

Question (25), "Who succeeded Kazimierz the Great as the king of Poland?" is a didactic question in its elliptical form; it is a complementation question. Whereas its paraphrase (25B), "Do you know who succeeded Kazimierz the Great as the king of Poland?" becomes a decision question. A consequence of completing didactic questions to their full form is that every didactic question becomes a decision question. And it means that such a question has only two proper answers:

(32) Yes, I do.
(33) No, I don't.

Although such answers are natural and proper responses to a decision question, it is doubtful whether anyone asking (25) would be satisfied with them. The person asking (25) would rather ask a subsequent question:

(34) Ok, then, who succeeded Kazimierz the Great as the king of Poland?

which means that we have returned to the starting point.

Admittedly, Ajdukiewicz is right that didactic questions are questions of a special type; perhaps their peculiarity results from their elliptical character. However, it seems that a certain amount of "complementation" is inevitable in a didactic question. It may be an argument for reducing didactic interrogative sentences to imperatives, as suggested by Brożek (2007, p. 232; 2011).

4.3. *Ambiguity of the Word "Is" and the Defence of the Principle of Contradiction*

In his article *Change and Contradiction* (Ajdukiewicz 1948/1978[7]) Ajdukiewicz argued against the claim that change involves contradiction. Supporters of this claim, such as Georgiy Plekhanov, maintained that we should accept a self-contradictory sentence:

(35) A body in motion is and is not in a definite place.

and, accordingly, reject the principle of contradiction. In reply, Ajdukiewicz pointed out that (35) is defective: the word "is" appears twice but has different meanings in the first and in the second occurrence (Ajdukiewicz 1948/1978, p. 199). Namely, "is" in (35) may be understood either (a) in a broad sense: as referring to some kind of being somewhere, having contact with something, or (b) in a strict, special sense: as referring to being in a particular place ("to be" in the strict sense is synonymous with "to stay"). When Plekhanov says that "a body in motion is in a definite place," he uses the word "is" in the broad sense, but when he adds that "a body in motion is not in a definite place," he must have the strict sense in mind.

When one replaces the ambiguous word "is" in (35) with its univocal synonyms, the whole sentence runs as follows:

(36) A body in motion has a contact with some place and does not stay in it.

Since (36) does not entail two sentences which would be mutually contradictory, it is not the case that change involves contradiction.

[7] The Polish version of this text is *Zmiana i sprzeczność* (Ajdukiewicz 1948/1985).

4.4. *Application of the Method of Detecting and Eliminating Vague Terms*

As we have seen, by a "vague term" Ajdukiewicz means an expression which has an unstable denotation: there are objects which are definitely designated by the term, there are objects which are definitely not designated by a term, and there are objects which may or may not be designed by the term. An example is the word "a youth."

4.4.1. Firstly, in *Konwencjonalne pierwiastki w nauce* [*Conventional Elements in Science*] (Ajdukiewicz 1947/1985), Ajdukiewicz employed the method of detecting and eliminating the vagueness of words to defend a version of conventionalism.

He begins by reporting a critique of conventionalism. According to the critics of a certain version of conventionalism, the one put forward by Henri Poincaré, the conventionalist approach has methodologically negative consequences: it leads to the thesis that all knowledge within natural science is ostensive in character, or that it is just a mental object which is not based on empirical data (Ajdukiewicz 1947/1985, p. 42).

Ajdukiewicz's support was not so much for conventionalism *tout court* as for the claim that science is conventional – which is liable to misunderstanding. It is not the scientific *statements* themselves that are conventional. Let us recall that according to Ajdukiewicz, the conceptual apparatus of a given scientific discipline consists of notions, the majority of which come from everyday language; their sense is being "sharpened," if necessary, so that they can fully contribute to the scientific apparatus. And what is conventional within science is just the sense given to a notion of everyday language in order to exploit it in the scientific domain.

4.4.2. Ajdukiewicz observed that detecting and eliminating vague terms may also support the defence of the principle of contradiction.

As it has been mentioned above, Ajdukiewicz argued that change does not involve contradiction by pointing out that the word "is," as referring to a body in motion, is ambiguous. He put forward one more argument for his position. The gist of the argumentation for the claim that change implies contradiction is as follows: to admit that there is something like change means accepting as true, two sentences about change; yet these sentences are mutually contradictory, which threatens the principle of contradiction. One may then either admit that there is change and reject the principle of contradiction, or accept this principle and deny any change in the world.

Ajdukiewicz notices a fallacy in this reasoning; the fact that one is unable to decide which of two sentences is true and which is false does not imply that neither of them is true. Consider the following sentences:

(37) John is young.
(38) John is not young.

where "John" refers in both cases to the same person. The term "young" is vague. One may say about some objects that they are designated by this term, and that they are young; likewise, some objects are definitely not young. But there are also objects which may or may not be designated by "young." As regards our example, there are contexts in which (37) is true and (38) is false (*e.g.* when we refer to John who is seventeen), and vice versa, there are contexts in which (37) is definitely false (when we refer to the same John who is eighty-five). But which sentence is true about John who is thirty-five? It is not decidable because the word "young" is vague. However, and this is the crucial point, it does not follow from that that neither the sentence (37) nor (38) is true about John who is thirty-five. What follows is just that one cannot decide which sentence is true about a 35-year-old John.

According to Ajdukiewicz, the same applies to the set of two contradictory sentences about change (where *B* is a body):

(39) *B* is in motion.
(40) *B* is not in motion.

Admittedly, one cannot decide or does not know which sentence is true and which is false. However, it does not mean that neither of them is true. Consequently, there is no reason for rejecting the principle of contradiction.

5. Conclusion

It is safe to say that detecting and eliminating semiotic defects can be counted among the favourite and most efficient philosophical methods used by Ajdukiewicz (the other one would be his original method of paraphrasing sentences; *cf.* Będkowski, draft). By revealing that some kinds of utterances, such as didactic questions, intensional sentences, or expressions containing the verb "is," are defective, we can formulate them correctly and often – like in the case of the objections against the principle of contradiction or against the conventionalist position – evade and explain away fallacious lines of argumentation.

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METAPHYSICS AND ONTOLOGY

Ryszard Kleszcz

KAZIMIERZ TWARDOWSKI ON METAPHYSICS

1. The issue that I address in this text concerns Kazimierz Twardowski's approach to the classic discipline of philosophy, *i.e.* metaphysics. Establishing the views of the Lvov-Warsaw School creator in this matter requires considering also such issues as: philosophy's approach to science, how Twardowski perceived philosophy, its subject, methods and in what he saw the specificity of particular sciences (natural sciences, mathematics, and humanities). Moreover, new questions are evoked by the issue of the place of metaphysics, especially concerning the relations of philosophy to an area called outlook on life.

Analyzing these issues one should take into account a possible change of Twardowski's views on issues as the subject of our interest. It is known that a significant change in his views took place around 1902, when under the influence of *Logische Untersuchungen* by Edmund Husserl he abandoned psychologism in the area of logic. Such changes could take place also in relation to other issues, inclusive of those relating to metaphysics, its perception and place within philosophy. This text is devoted to these matters.

2. The metaphilosophical issue, inclusive of the one relating to metaphysics, its place and role, appears in an introductory lecture held by Twardowski after he was employed at the Lvov University as a professor of philosophy on November 15, 1895.[1] His views presented at the University do not differ strongly from the earlier Vienna period.[2] Philosophy, as perceived by Twardowski, is a sum of philosophical sciences of which the most important are: metaphysics, the theory of knowledge, psychology, logic,

[1] *Cf.* Twardowski (1994), pp. 227–236.
[2] *Cf.* Brożek (2010), pp. 73–116, 156–212.

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ethics and aesthetics.[3] Thus, we have to do with a collective perception of philosophy; philosophy as a set of disciplines. According to Twardowski, philosophical disciplines are usually visibly distinguished from and even contrasted with particular sciences which are called by Twardowski special sciences. It is especially visible if, on the one hand, we have philosophical disciplines, and on the other – natural sciences. At least three reasons support this view. In philosophy there are – contrary to science – various, contradicting schools. Secondly, they are to be differentiated by methods and third – the subject they busy themselves with. Twardowski does not question the fact that philosophy differs from the sciences called special sciences. According to him, however, it is not justified to exaggerate by stressing the differences between philosophy and special sciences. One of the significant differences often touched upon is the variety of philosophical points of view and the existence of numerous philosophical schools. According to Twardowski the existence of numerous competitive schools in philosophy is mostly due to one of philosophy's fields, *i.e.* metaphysics because within metaphysics one deals with a situation characterized by Twardowski in the following way:

> Idealism or realism, spiritualism or materialism, dogmatism or skepticism, monists and dualists, *etc*. are the emblems under which philosophers praise their own intellectual work and criticize others' intellectual work (Twardowski 1994, p. 227).

A clear-cut contrast of philosophy and natural sciences is – according to Twardowski – not right because the analysis of natural sciences reveals the existence of conflicting points of view also within them. In this matter and in relation to the method, about which I am writing below, the difference between philosophical sciences and natural sciences would be a difference pertaining to a degree rather.

If we take into consideration the study subject, in the case of natural sciences it is objects and natural phenomena. Philosophical sciences, in turn, would study mental (spiritual) phenomena.[4] However, if we look closer at metaphysics, it will be possible to state that it is such a philosophical discipline which, to some extent, studies also subjects that are neither mental nor sensorial. Twardowski says:

> Next to sensorial and mental phenomena, there are also phenomena that cannot be ascribed to either of the two categories… For example, various relations… Thus the whole theory of relations belongs to metaphysics. … There is (also) a whole range of

[3] In another popular book, Twardowski states: "Logic, psychology, ethics, aesthetics, philosophy of law, philosophy of history, philosophy of religion, the theory of knowledge and metaphysics are called philosophical sciences." *Cf.* Twardowski (1901), pp. 80–81.
[4] *Cf. ibid*., pp. 228–229.

> issues whose subject is nothing mental or sensorial but which relate equally to mental and sensorial things. The question of where the whole world comes from – the soul and the body – belongs to these issues; further, studying the relation between the mental and sensorial world; and when we ask about the purpose of the universe, the answer should be sought in metaphysics (Twardowski 1994, p. 229).

Thus one can see that Twardowski in his lecture classifies answers provided by metaphysics as scientific ones and at that time treated the discipline itself as one belonging to the philosophical sciences. However, metaphysics busies itself not only with the relations theory but also with problems such as the universe's origin, the relations between the mind (soul) and the body or the purpose of the universe, as well as the problem of God and his existence. In his post-doctoral thesis (habilitation) of the same period (published in 1894) he speaks about metaphysics as a science related to being.[5] This approach to metaphysics would thus be in concord with its classic perception by Aristotle. In that period Twardowski also rejects a clear positivistic refutation of metaphysics evaluating this position as narrow and noticing:

> There are numerous objects with which metaphysics could busy itself; there is a lot of material for work and only the narrow horizon of positivists does not allow them to correctly evaluate the significance of these issues (Twardowski 1994, p. 229).

In that period Twardowski also addresses, especially in his more popular works, detailed issues related to classically perceived metaphysics because such is the character of the human soul, its relation with the body (the psychophysical problem) and its immortality. He addresses these issues in some of his works (in Polish).[6] Here, I would like to shortly indicate two issues, *i.e.* the problem of the soul and the matter of its (possible) immortality. In the first case – the problem of the soul – Twardowski accepts the existence of a being which is the subject of mental phenomena. The existence of this being should be treated as directly obvious. This being is described by Twardowski as the soul. The soul is indivisible and permanent, and the mental phenomena that we perceive are related to: "… the only 'I' existing among variable and still newer symptoms of spiritual life."[7] When it comes to the issue of philosophical argumentation, manifesting the immortality of

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[5] *Cf.* Twardowski (1894). English translation: Twardowski (1977), p. 36: "If the object of presentations, judgements, and feelings is nothing else but the Aristotelian- scholastic end, then metaphysics must be definable as the science of objects in general, taking this word in the sense here proposed."

[6] *Cf.* Twardowski (1895b) and (1895c). In the period 1894/95 Twardowski lectured in Vienna University as *Privatdozent* on the immortality of the soul (German lecture title: *Die Unsterblichkeitsfrage*).

[7] *Cf.* Twardowski (1895c), p. 472.

the soul, there are, according to Twardowski, three types of argumentative procedures ("proofs"). They are: the experimental method; the deduction method; and the induction-deduction method. The last one is considered to be the most appropriate one.[8] In his argument he assumes that what is a simple being is indestructible (eternal). According to Twardowski natural sciences authorize us to accept such a thesis (the law of the preservation of energy). The soul, as Twardowski perceives it, is to be simple and indivisible which he assumes on the basis of philosophical deliberations. Thus, we have two premises:

(P1) that which is a simple being is indestructible,
(P2) the soul is a simple being,

On the basis of the above one can arrive at the following conclusion:

(C) the soul is an indestructible being, thus it is eternal.

A reader of Twardowski can find a similarity between this argument and one of those found in *Phaedo* by Plato.[9] Twardowski stresses the fact that both premises, P1 and P2, are only probable and that is why the conclusion is also of such a probable character. It can be, however, supported until its opponents prove it is false.

In a later period Twardowski would address some issues related to a psychophysical problem,[10] although he would drop the idea that there are convincing philosophical arguments for the soul's immortality. However, simultaneously, he would accept the conviction which assumes the human soul's immortality.

Metaphysics, as perceived by Twardowski in the mid-90s of the 19th century, busies itself with: (1) the theory of relations; (2) any type of physical and psychical objects, real and unreal, existing and not existing; (3) general questions on the soul, its character and its immortality, the purpose of the world or the existence of God. When it comes to point (2) it should be added that the particular sciences busy themselves with the characteristic traits of individual groups of objects defined as physical or psychical. In contrast to these sciences, metaphysics busies itself with both physical and psychical objects. In relation to these various types of objects it would formulate laws to which these objects in general would be subordinate and not only their individual groups. In general, the conception of metaphysics

[8] *Cf.* Twardowski (1895b), p. 430.
[9] *Cf.* Plato, *Phaedo,* 78 B–C.
[10] *Cf.* Twardowski (1995), pp. 25–29.

in Twardowski's view, in his early works, is in concord with an approach typical for Franz Brentano.[11]

Now, if we have a look at the research methods characteristic for science, it should be noted that in the standard approach the appropriate and specific method for natural sciences is the induction method.[12] This, however, requires some complement. In some sciences of this type, description (zoology) or the deductive method (mechanics) prevails. As a result, it is necessary to assume that induction is not the only method applied in the natural sciences. According to Twardowski there are no big differences in comparison to the philosophical sciences. In their case description (descriptive psychology), induction (other areas of psychology) or deduction (logic) also sometimes prevails. Metaphysics, in turn, may use description, induction as well as deduction. Of course, as Twardowski stresses, there is a difficulty here. It is connected with a lack of general rules from which one could derive results by deduction. There were attempts to find such general rules a priori. Such an approach characterized traditional philosophy and made the cognitive progress impossible. Such a progress can be found in modern natural sciences in contrast to metaphysically oriented philosophy. Thus, for someone formulating his contemporary philosophy in such a way, the postulate of bringing it closer to science will be obvious.[13] Such are also the solutions which Twardowski assumes, indicating that in philosophy there is time for rejecting the unfavorable development of apriorism in favor of empirism. This movement can be credited to such philosophers as: Herbart, Lotze and Brentano because:

> They quit proposing allegedly a priori theses and in reality arbitrary ones; they indicated the fact and phenomena analysis, held up as a model a method due to which the natural sciences achieved such great results – and from then on a new epoch in philosophy, and especially in metaphysics began (Twardowski 1994, p. 233).

In general, one can say that, according to Twardowski, the efforts taken previously to build metaphysical systems were unsuccessful. However, he stresses that it is possible to build such a metaphysical system which

[11] *Cf.* Smith (1994), p. 159: "What, then, was the metaphysics to which Twardowski himself subscribed? The answer to this question is clear from a perusal of his work it is the metaphysics of Brentano." Also see Brentano (1924–25), §1.

[12] *Cf.* Twardowski (1923), pp. 180–190.

[13] Models of bringing philosophy close to science can be found in Brentano's famous slogan: *Vera philosophiae methodus nulla alia nisi scientiae naturalis est*. However, as we know, this slogan of the Austrian philosopher does not prove his sympathy for positivism or radical naturalism.

would be based on natural sciences.[14] However, he simultaneously notices that building a perfect system in this area is doubtful. The difficulty is that its subject – while indicating a metaphysical subject – would have to be the whole world, its past and future.[15] Metaphysics is a peculiar discipline among the philosophical sciences because of its subject and various methods. At the same time, however, as it has far-reaching cognitive ambitions, it differs from special sciences more than other philosophical sciences.

The analysis of relations between philosophy and sciences indicates, according to Twardowski, that a thesis on the essential distinction between the philosophical and natural sciences (except for metaphysics) cannot be justified. Philosophy should be practiced on the basis of the methodological standards of science. Twardowski thinks that philosophy can be scientific only if one quits the apriorism, characteristic of traditional philosophy and reaches for models of natural sciences. As Twardowski stresses:

> Philosophy is also a science, it is also an ability, just like any other; its goal is to search for the truth and the truth in every subject can only be one; no man knows all the truths but if someone shows them to us in any area, we will accept them willingly and with gratitude (Twardowski 1994, p. 236).

Thus, in scientific philosophy, just like in science, similar methodological rigor should be applied, which on the one hand would concern the language and on the other hand – justification. This scientific philosophy program was outlined by Twardowski in his *Psychologia wobec fizjologii i filozofii* of 1897.[16]

3. The mentioned program outlined by Twardowski is clearly related to Brentano's views.[17] Therefore, where they concern metaphilosophy, they should be presented at least in general. This philosopher from the beginning referred to Aristotle whose views he respected, commented on and developed.[18] Brentano expressed his philosophical credo in his set of theses submitted for post-doctoral discussion (habilitation) in 1866.[19] This set is comprised of 25 theses, the first four of which are of a metaphilosophical

[14] Later, this issue was not taken up again or developed by Twardowski. Thus, it is worth noting that to some extent, metaphysics, which Tadeusz Czeżowski – a student of Kazimierz Twardowski – defines as inductive (generalizing), is of this character. These metaphysical theories go not only beyond the limits of science but also beyond the limits of experience in general. *Cf.* Czeżowski (2004), pp. 50–59.
[15] *Cf.* Twardowski (1994), p. 234.
[16] I write about this issue in more detail in: R. Kleszcz (2013), pp. 21–63.
[17] *Cf.* Chisholm (1982), *passim*; Smith (1994), pp. 7–86.
[18] *Cf.* George, Koehn (2004), pp. 20–44.
[19] *Cf.* Brentano (1968), pp. 136–141.

character and the rest of which are related to: ontology (metaphysics); psychology, logic; ethics and aesthetics. Here, we shall look at the first four theses, expressing, in a very abbreviated way, the views of the author on philosophy's status.

Thesis one reads in Latin: *Philosophia neget oportet*, *scientias in speculativas et exactas divisi posse; quod si non recte negaretur*, *esse eam ipsam jus non esset*. Thus, the first thesis expresses a conviction that philosophy should oppose a division of knowledge into exact sciences and those of a speculative character. It can be understood as a postulate that philosophy accepts the traits of science (scientificity). However, how this scientificity should be understood is clearly arguable.[20]

Thesis two: *Philosophia et eos*, *qui eam principia sua a Theologia sumere volunt*, *et eos rejicere debet*, *qui*, *nisi sit supernaturalis revelatio*, *eam omnem operam perdere contendunt*. This states that philosophy rejects the thesis that it takes its rules from theology, stressing at the same time the methodological differences between these two disciplines.

Thesis three: *Nihilominus verum est*, *sententias Theologia probatas eas esse*, *quae philosophis quasi stellae rectrices sint*. This thesis complements the second one, stating that theological statements can be guidelines in philosophical research. Simultaneously, however, a given thesis taken from theology should be treated (analyzed and potentially justified) with the use of tools pertinent to philosophy.

Thesis four: *Vera philosophiae methodus nulla alia nisi scientiae naturalis est*. According to this: "a philosophical method cannot be different from a natural science method." This thesis, very popular in those times, requires, however, an explanation and evokes many questions. There is, however, no doubt that along with thesis one, it stresses Brentano's approach according to which philosophy is to be a science.

The next seven theses are systematic theses of an ontological and metaphysical character. As an example let us indicate that thesis eight states that a thesis on the existence of an infinite number of worlds, their multitude or boundlessness is not true (*Est neque infinitus numerus aut omnino mundorom multitudo*, *nec mundus infinitae extensionis est*). Skipping the interpretation issues, it evokes a question of whether theses such as the above-mentioned one can be formulated as meaningful, assuming at the same time that philosophy uses the same methods as the natural sciences.[21]

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[20] To this difficulty, Roman Ingarden drew attention. *Cf.* Ingarden (1963), p. 202. Also Ingarden (1969), pp. 32–3 and 32–4.

[21] R. Ingarden sees an incohesion in the point of view of the Austrian philosopher. *Cf.* Ingarden (1963), p. 202.

The most important work which was published during Brentano's life was his debate *Psychologie vom empirischen Standpunkt* (1924–45). In the program of the Austrian philosopher, empirical psychology presented in this work became a necessary basis for philosophical studies.[22] The subject of these studies amounted to an analysis of mental life symptoms. For the Austrian philosopher, psychology was a discipline different from both the natural sciences and metaphysics. Natural sciences study characteristics of bodies to which external experience is applied while psychology studies such qualities to which internal experience is applied. Metaphysics in turn would be a discipline busying itself with facts which occur in internal and external experiences and thus they could be ascribed neither to the natural sciences nor to psychology. Thus, metaphysics, according to Brentano's, has a full right to exist as a philosophical science with its own subject.[23]

Twardowski is, as it is easy to notice, a philosopher for whom this methodological program is close and who is trying to realize[24] it. His point of view can thus be called brentanism, even if in that period there are some differences between his approach and Brentano's approach. This reference to Brentano's works can be noticed not only in Twardowski's works but also in his lectures about which his student Izydora Dąmbska writes.[25]

Twardowski assumes that philosophical disciplines can accept a fully scientific character if they abandon the metaphysicism which was so characteristic for philosophy in those times, as metaphysicism makes research in various philosophical areas dependent on the metaphysical views accepted by a given researcher.[26] Such a perception of philosophy does not allow giving it a character which would ensure its commonness and which would allow scientific justification of the formulated theses. Although metaphysicism has its supporters, many abandon it, turning towards the so-called psychologism. As Twardowski states:

> It is known as the "psychologism" of philosophy and in it a reaction against the former "metaphysicism" of philosophy is expressed. In short, the place of metaphysical speculations has been taken by psychological studies on those spiritual symptoms which still lead to appropriate metaphysical issues; the basis of philosophical work ceases to be metaphysics; the basis is now psychology (Twardowski 1897, pp. 106–107).

[22] *Cf.* Brentano (1968); Jacquette (2004), pp. 1–19; Smith (1994).
[23] *Cf.* Brentano (1968), pp. 1–11, 53–58.
[24] *Cf.* Paczkowska-Łagowska (1980), pp. 19–54.
[25] *Cf.* Dąmbska (1979), pp. 1–10. Also Dąmbska (1978).
[26] Metaphysics, with its traditional approach, was a discipline providing other disciplines with ready notions; it also decided about solutions accepted within the scope of individual philosophical disciplines. *Cf.* Twardowski (1897), reprinted in Twardowski (1965), pp. 92–113.

Thus, on the base of the new research approach, metaphysical questions on *e.g.* the essence of the truth, goodness or beauty are not at the beginning anymore. Instead, one strives – as Twardowski says – to describe mental activities. Metaphysical research can be only a consequence of that which has been previously established. As a result, in Twardowski's concept, descriptive psychology (empirical), as Brentano perceived it, becomes a necessary basis for all philosophical research.[27]

In Twardowski's concept, any objects of philosophical research could be amounted, to some extent, to the symptoms of mental life. Thus, psychology is for philosophy not only a method provider but also an object provider.[28] This point of view caused serious consequences. Essential research in the field of ethics, aesthetics or cognitive theory were to be in concord with the analysis of mental life symptoms. This is clearly visible in Twardowski's object theory. In his post-doctoral work (habilitation) (1894) he distinguished within a presentation: an act, the contents and the object.[29] In J.N. Findlay's opinion:

> [Twardowski's *Zu Lehre vom Inhalt und Gegenstand der Vorstellungen*] is unquestionably one of the most interesting treatises in the whole range of modern philosophy; it is clear, concentrated, and amazingly rich in ideas (Findlay 1963, p. 8).

These names reflect the psychical relations which match them. Thus, each name has three roles. First, it indicates that those who use it imagine something, which means that a psychical act occurs in them. Second, it evokes in the recipient a certain psychical content which is the meaning of the name. Third, the name names an object which is presented in the presentation. Thus the meaning in this concept is a certain psychical content.[30] Philosophy is now a group of sciences but a characteristic thing for these sciences is that they study given objects either only in internal experience or both in external and internal experience. To the first group, psychology can be ascribed, as well as ethics, logic, aesthetics and a theory of

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[27] About this issues *cf.*: Słoniewska (1968), *passim*; Rzepa (1993), pp. 34–44.

[28] The stress put by Twardowski on the meaning of psychology was criticized by his student Jan Łukasiewicz who represented a radical type of antipsychologism. *Cf.* Łukasiewicz (2013), pp. 65–66.

[29] *Cf.* Twardowski (1977), pp. 1–8. In John Passmore's opinion: "Meinong came to distinguish sharply between content and an object with the help of the Polish philosopher K. Twardowski, who in his *Towards a Theory of the Content and Object of Presentation* (1894) had distinguished three distinct elements in a 'psychical phenomenon' – the mental act, its content, and its object." *Cf.* Passmore (1966), pp. 180–181, 195. The matter of the priority of this differentiation is sometimes arguable because aside from Twardowski, A. Meinong and G. F Stout may aspire to it. See also Smith (1994) pp. 160–200.

[30] *Cf.* Twardowski (1977), pp. 8–11.

knowledge. To the second group, metaphysics would belong, which studies objects given to us in an external and internal experience. That is how Twardowski characterizes its objects:

> There are, however, some objects of knowledge which in a more or less direct way uncover the external and internal experience. Here, one should enumerate first of all the majority of relations, … The so-called theory of relations busies itself with them. Further, there is a whole range of notions which we shape also on the basis of data which is provided by both types of experience; these notions include, inter alia, the notions of change, substance, ailment and causality. Also issues appear which relate both to the objects of internal and external experience. These are issues which occupy the human mind to the largest extent: the issue of the beginning of the universe, the question of if at all and to which goal its development goes, the issues of the material world's approach to the spiritual world, *etc*. (Twardowski 1897, p. 110).[31]

Twardowski in his post-doctoral thesis (habilitation), as I have mentioned before, defined metaphysics as a science that studies all objects. Thus, it is, according to the classic perception, a science of being.[32] Twardowski's perception of objects indicates at the same time that he did not reduce objects to one category and his ontology was rather a pluralistic ontology. It is characteristic that in his *Psychologia wobec fizjologii i filozofii*, of 1897 there is still, within the frameworks of scientific philosophy, a place for metaphysics perceived from the point of view of its objects, just as it was in *Wykład wstępny*. The difference is that Twardowski stated that metaphysics should be preserved for the end of the research and should be preceded by psychological research of spiritual life symptoms. While previous philosophical research (and thus also psychological research) was started with metaphysics, now willing to approach the metaphysical system, it was necessary to start from experience, from the psychological research. This allowed Twardowski to make a final statement that psychology was the basis and that metaphysics supplemented philosophy, being a final stage of philosophical research.[33]

In that period (1897) metaphysics had, according to Twardowski, a place within the philosophical sciences.[34] At the same time it was psychology

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[31] *Cf.* Twardowski (1897), p. 110. From this perspective metaphysics is a philosophical science which covers all that people perceive in external and internal experience.

[32] "Metaphysics is a science, which considers all objects, physical – organic and inorganic – as well as mental, real as well as nonreal, existing objects as well as nonexisting objects." *Cf.* Twardowski (1965), p. 36.

[33] *Cf.* K. Twardowski (1897), p. 113.

[34] Although Twardowski's remarks seem to prove it, he already has doubts speaking about distinguishing still new disciplines of philosophy: "finally, of the previously common ability there will be nothing left but metaphysics; and one can doubt if it can be ascribed to." *Cf.* Twardowski (1897), p. 105.

and not metaphysics that started to play the role of the basic philosophical science. Such an approach, however, evokes consequences that are hard to accept, especially in logic.[35] In relation to logic, it was necessary, standing on the psychologism ground, to accept that it busies itself with the analysis of mental processes occurring when one strives to achieve some type of beliefs. The aim of logic as a science – in this approach – would be formulating thinking rules. In some version the psychologism point of view led to a thesis that logic was a branch of psychology. Psychologism was, however, totally criticized by Frege in his *Die Grundlagen der Arithmetik* and by Husserl in his *Logische Untersuchungen*. Twardowski was strongly influenced by Husserl and about 1902, abandoned the psychologistic point of view. This antipsychologistic approach was strengthened in the Lvov-Warsaw school and was visible in the early works of the first Twardowski's students.[36]

4. At the beginning of the 20th century Twardowski's approach to metaphysics as a philosophical science became more critical which can be visible in his criticism of metahpysicism as a source of cognitive delays of philosophy in comparison to science. At the beginning, Twardowski expressed a moderate optimism, acknowledging however, that the structure of the metaphysical system required many preparatory works. A place for metaphysics as a philosophical science, although not without reservations, can be found in *Psychologia wobec fizjologii i filozofii*, so in 1897.

In a later period doubts on metaphysics' status would become stronger. Traces of this can be found in various texts and sometimes in short remarks of Twardowski. In the 90s, as I have mentioned before, Twardowski was an author of publications in which he clearly supported the immortality of the human soul. In the meantime in his lecture *Dusza i ciało*, held within the scope of Common University Lectures in 1903, Twardowski stated that to questions on the essence of the soul, its pre-existence and post-mortal existence, there is no philosophical (and thus constituting knowledge) answer.[37] This means that the notion of the soul's character and its immortality important for metaphysics is excluded from scientific philosophy. In 1910, a popular book by Twardowski was published which was devoted to the history of medieval philosophy.[38] In this work Twardowski formulated

[35] On Brentano's view see: Rollinger (2009), pp. 1–23.
[36] Antipsychologism is especially visible in the works of Jan Łukasiewicz who expressed it to the fullest degree in his (1907). *Cf.* also Kleszcz (2009), pp. 163–170.
[37] *Cf.* Program of this lecture included in: Common University Lectures Programs (in Polish), Lvov 1903, IV, series II, p. 6, series III, p. 13.
[38] *Cf.* Twardowski (1910).

views indicating an increasing distance towards metaphysics and metaphyscical philosophy. He expressed a view that it was not possible to prove the existence of God, his relation to the world and human beings with the help of philosophical tools. He states, *inter alia*:

> God and his approach to the world and human beings cannot be a subject of rational knowledge but only of religious faith. Thus, philosophy cannot judge in these matters because they are beyond the range of its cognitive tools (Twardowski 1907, p. 107).

And this issue is transferred by him to the perception of the world, beyond scientific philosophy. In the work *O psychologii*, *jej przedmiocie*, *zadaniach*, *metodzie*, *stosunku do innych nauk i jej rozwoju* of 1913, doubts as to whether metaphysics is of a scientific character at all are mentioned. He does it in the context of the so-called rational psychology, considered as an area of metaphysics. As Twardowski states:

> Psychology as a science about the soul and its essence constitutes, under the name of "rational psychology," one of the branches of metaphysics, because of which its scientific character is subject to all doubts which concern also the scientific character of metaphysics[39] (Twardowski 1913, point II *ff*.).

Twardowski's arrival point is a position in which metaphysics is placed outside philosophy as a reflection on outlook studies and their status. An essential part of what Twardowski considered as metaphysics, still perceived as science, he now includes in the area of the outlook (metaphysical outlook). And this area is not a part of scientifically perceived philosophy. It is well visible especially in a speech of 1929 held during a meeting on the occasion of the 25th anniversary of the Polish Philosophical Society. Twardowski, in his speech, placed metaphysical issues, except for the relations theory, beyond scientific philosophy.[40] Hence, Twardowski's postulate on separating philosophy and the metaphysical outlook. For Twardowski it was obvious that people had and have convictions of an outlook character. The practical value of these convictions is enormous. As Twardowski mentions:

> Philosophical views on the world and life are of a great value for their advocates making signposts for their opinions on the world, human environment and themselves (Twardowski 1965, p. 381).

Once this type of views is not scientific, it is thus not rational. However, as Twardowski stresses, they do not have to be unreasonable and thus they do not have to contradict scientific theses. He defines this type

[39] *Cf*. also in (Twardowski 1965), p. 242.
[40] Twardowski (1929), pp. 1–5, in: Twardowski (1965), pp. 379–384.

of views as irrational. In a human being's life an essential part of various important views from the perspective of life belong to this category.[41]

Twardowski's view separating scientific philosophy from outlook was supported by some methodological reasons. When it comes to philosophical methods it should be mentioned that according to Twardowski, an important role is played by the analytical method (the method of analytical description). In this method one begins with simple examples on the basis of which one provides analytical definitions of the studied objects. On the basis of these definitions, one formulates analytical statements which may be empirically checked in the given subject area. This type of procedure ensures not only keeping in line with empiricism but also allows making the tools used by a philosopher more precise. This method makes it possible to make the used terminology more subtle, to catch the meaning(s) of the used terms, to extract those issues that disappear among linguistic misunderstandings. These methodological assumptions made by Twardowski cannot, however, be used if one wants to answer some final questions related to the human being and the world. This area, also because of these reasons, according to assumptions indicated by Twardowski, has to remain beyond scientific philosophy. The above analysis indicates that Twardowski's criticism of metaphysics and metaphysical philosophy becomes stronger and stronger with time, leading as a result to the separation of metaphysics and scientific philosophy.

5. This philosophical attitude of Twardowski, expressing itself in relation to the previously discussed issues, may be shortly characterized as: a) brentanism, b) psychologism (at least till 1902); c) moderate scientism; d) empiricism. His views on the relation between philosophy and science make it possible to ascribe him to the representatives of an approach which, neither pronounces full the autonomy of philosophy nor postulates its liquidation, according to the postulates of radical positivism.

The above-mentioned change of approach to metaphysics is also visible in the lectures program held by Twardowski. Kazimierz Twardowski held his lectures at Lvov University in 1895–1931.[42] An analysis of a list of his lectures (and classes and seminars as well) indicates clearly that in his program he was driven by his metaphysical views and the desired philosophical education standards. A big majority of his lectures concerned various issues of psychology, the history of philosophy and logics. In the academic year of 1899/1900 a lecture was presented on *Reformatory Tendencies in*

[41] *Cf.* Kleszcz (2013), pp. 203–222.
[42] *Cf.* Jadczak (1991), pp. 59–77.

Formal Logic (in Polish) which was the first presentation in Poland devoted to a general familiarization of students with new trends in logical research. That is what Peter Simons writes about this lecture:

> Twardowski, Brentano's last important Viennese student, taught a course on the reform of logic at Lwów, and his lectures, while rudimentary by later standards, were attended by or at least known to later stars of the Lwów-Warsaw School such as Łukasiewicz and Leśniewski (Simons 2004, p. 63).

All these subjects were supposed to implement appropriate standards and teach the culture of intellectual work at the highest level and at the same time introduce a tradition of philosophical thinking. What is worth mentioning, is a rather weak representation of classes on the theory of knowledge and metaphysics.[43] It was the result of a growing skepticism towards this discipline.

6. The above-mentioned view of Twardowski is worth discussing in more detail and to be the subject of critical analysis. Here, I shall only mention the arising doubts. At the beginning Twardowski treated metaphysics as a fully-fledged philosophical discipline, applying to it the classic problems with which metaphysical philosophers had busied themselves in the classic and modern periods. Then, however, he dropped this view, stating that a majority of metaphysical issues (except for relations theory) should be ascribed to the metaphysical outlook area. These, in turn cannot be studied and solved with the use of methods appropriate for scientific philosophy. This view differentiates him clearly from the view represented by Brentano who took up, during his whole life as a philosopher, various issues of metaphysics, inclusive of issues related to the existence of God and personal immortality. As a modern researcher stresses:

> Although Brentano broke with organized religion in the late 1870s, he remained a traditional theist all his life and was still writing (by dictation) on subjects in natural theology in 1917 (Krantz 2004, p. 237).

In relation to the problems of metaphysics as a part of philosophy and the indicated issues of the so-called natural theology, Twardowski's point of view was clearly more unfavorable than the view of his teacher which he did not abandon till the end of his life.

This view of Twardowski may evoke various questions and doubts. Shortly speaking, the view that philosophical experiences of the 20th

[43] In the indicated list we can find only three lectures devoted to this topic. In the winter semester of the academic year of 1899/1900 there is a lecture on *Basic Issues of the Theory of Knowledge and Metaphysics*, and in the winter semester of 1917/1918 and summer semester of 1924/1925 there is a lecture on *Theory of Knowledge.*

century are against such a simplified disposal of metaphysical problems seems justified. But even rejecting a scientific philosophy postulate, as perceived by Twardowski, and assuming that research in the area of metaphysics has a right to be present in philosophy, one has to remember about one thing: such metaphysical research has to be carried out according to a reliable input of logical and methodological standards which are provided especially, but not exclusively, by modern analytical philosophy. And in this sense the reflections of Brentano and Twardowski on philosophy and its status, and stressing these standards still seem to be valuable and worth taking into consideration.

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Anna Brożek

KAZIMIERZ TWARDOWSKI ON PHILOSOPHY AND SCIENCE[1]

Kazimierz Twardowski is considered one of progenitors of analytical philosophy. Among typical features of such a philosophy, we find – as it is commonly known – a tendency for detailed analysis of small (particular) problems and, in connection with that, disinclination to philosophical systems, tracking of every unclearness, unmasking superstitions, attachment to precision of language (as a tool of cognition) and, finally, making use of results and methods of natural and formal sciences in philosophical deliberations. This text is devoted to the last of these features in Kazimierz Twardowski's thought.[2]

1. Twardowski's Interests

Twardowski's interests in natural science arose together with his philosophical interests. He was concerned with both types of disciplines already as a teenager pupil of the Viennese *Theresianum*. It is very instructive to reconstruct the circumstances of the origins of his interests, since these circumstances had an important influence on the issues of Twardowski's research.

Twardowski's first confrontation with philosophy was connected with revisions in his worldview. In the third class of *Theresianum*, he read a book, famous at that time, of Ludwig Büchner – *Kraft und Stoff*. Twardowski's meeting with the worldview so dramatically different from the one instilled in him by his upbringing, made a strong impression on him.

[1] The article is a result of the project "The Significance of the Lvov-Warsaw School in European Culture," supported by Foundation for Polish Science.

[2] Some elements of Twardowski's philosophy of science analyzed here were discussed *i.a.* in: Dąmbska (1939), Kokoszyńska (1977), Woleński (1989) and Jadacki (2003).

In: Anna Brożek, Alicja Chybińska, Jacek Jadacki and Jan Woleński (eds.), *Tradition of the Lvov-Warsaw School: Ideas and Continuations* (*Poznań Studies in the Philosophy of the Sciences and the Humanities*, vol. 106), pp. 153–176. Amsterdam/New York, NY: Brill | Rodopi, 2016.

This book also revealed Twardowski's inclinations towards strict analysis and solid argumentation. In his intellectual "Autobiography," he wrote:

> This initial acquaintance with a world-view that was not just different from the Catholic, but indeed inimical to it, made [...] a great impression on me. But this impression quickly faded when on a closer reading I realized that Büchner's expositions were riddled with logical errors. I immediately started a notebook into which I entered Büchner's logically flawed arguments, and – since, of course, I was not at the time familiar with the rules of logic – exposed their defectiveness by replacing the mode of demonstration employed by Büchner with a suitably different, concrete example, which blatantly exposed the inadequacy of the former (1926, p. 18).

The conviction that the argumentation of materialists is insufficient was maintained by Twardowski throughout his life.

One of the sources of Twardowski's interest in natural sciences was a woman – Helena Gostkowska, who was an object of Twardowski's feelings when he was a student of *Theresianum*. Helena was a daughter of baron Roman Gostkowski (1837–1912), a physicist and engineer, who lived for some time in Vienna, then became a professor of Lvov Technical University. He was the author of many studies concerning physics and engineering, and one of the first publications concerning space travel.[3] From Twardowski's *Diaries* we know that baron Gostkowski was favorably disposed towards him – but it seems that he saw in Twardowski rather a future scientist than a future son-in-law. It was Gostkowski who suggested to him some publications on natural sciences. Twardowski's interests in mathematics and natural sciences were renewed a few years later, when he participated in lectures on physics and mathematics within the frame of his philosophical studies.

Physiology, medicine and psychology became objects of Twardowski's interest under the influence of his friend (and later also his brother-in-law, *i.e.* his sister Zofia's husband) – Józef Krypiakiewicz, a medicine student, and later a physician. Krypiakiewicz suggested to Twardowski to read, *i.a.*, the works of Charles Darwin and *Diaries* of Julian Ochorowicz. Both of these scientists made a significant impression on the future philosopher.

In his "Autobiography," Twardowski thus recalled university lectures in the domain of physics and mathematics:

> Since as a young man intent on philosophy I felt the need to acquire a comprehensive scientific background, if I may put it that way, that is to say, to gain familiarity with the principles and methods of the major types of sciences, in addition to philosophy,

[3] Gostkowski's second daughter, Zofia Anna, was one of the first woman-politicians (she was a member of the Polish Parliament). She was married to Jędrzej Edward Moraczewski, an engineer and the prime minister of the Polish government.

> I initially enrolled in history courses with [Heinrich] Zeissberg and [Max] Büdinger, then in mathematics with [Gustav] Escherich and [Emil] Weyr, and physics with [Joseph] Stefan. Convinced that some background in physiology is indispensable to a psychologist, I was impelled to attend the lectures and seminars of Siegmund Exner, animated as these were by the most exuberant interest in psychology (1926, p. 21).

Twardowski's works are a testimony to the fact that Twardowski knew very well the state of development of science in his times (*i.e.* at the end of the 19th century).

The most important event during Twardowski's studies was his encounter with the philosophy of Franz Brentano, whose philosophical *credo* was the conviction that philosophy should be practiced as a science, with attention to precision and exactness, and should use the same types of reasoning which are used in particular sciences. The characteristic feature of Brentanian philosophy was making use on inner experience.

2. Classification of Sciences

Brentano was Twardowski's true master. Thus, one could think that when Brentano had suggested him to analyze – in his habilitation thesis – the problem of classification of sciences, the proposal was accepted unconditionally.

However, Twardowski's decision was different. We read in "Autobiography":

> Initially I had a different thesis in mind for it [*scil*. my habilitation thesis]. At the time, Brentano had recommended that I investigate Aristotle's division of science. But follow as it did on the heels of my doctoral dissertation, which was devoted to a historical problem, I did not once again wish to deal with a theme from the history of philosophy, especially since at the time I had developed a lively interest in a different complex of issues (1926, p. 23).

Still, the issue of classification of sciences – in its systematic, not historical version – was very dear to Twardowski. It was also analyzed by many of Twardowski's students. Twardowski brought up this problem only once, in a short article (1923), which has an important position in the history of philosophy of science, since it provoked research and works of many members of the Lvov-Warsaw School and anticipated some ideas of the main figures of Western philosophy of sciences. Let me reconstruct some of his thoughts.

2.1. *Aprioristic* (*a priori*) *and Aposterioristic* (*a posteriori*) *Sciences*

Sciences may be classified with respect to various criteria, *i.a.*, from a methodological point of view, into deductive and inductive sciences, and

into aprioristic and aposterioristic sciences. Usually, one assumes that these two classifications are dependent: aprioristic sciences are also deductive, and aposterioristic sciences are also inductive. However, some methodologists claim that each of these classifications, taken separately, is invalid, because in fact every science is aposterioristic or all the sciences are deductive. According to Twardowski, such misunderstandings may be explained by specifying some concepts engaged in these classifications – in particular, the concepts of science based on experience, science based on reason, science based on induction, and science based on deduction.

According to Twardowski, the principle of classification of sciences into empirical and aposterioristic ones is neither the source of *concepts* in these sciences, nor the way one formulates *statements* (theses) of them. He notices that, firstly, some statements of every science have its source in the so-called genial intuition. Secondly, it happens that one reaches a statement in empirical sciences by reasoning or that one reaches a statement in aprioristic sciences by experiments. Twardowski gives the following examples: Urbain Leverrier, as a representative of astronomy (counted among empirical sciences), predicted the existence of an unknown planet in the Solar System (*scil*. Neptune), as well as the localization of this planet. On the other hand – Archimedes hit on the idea of a theorem concerning parables (*scil*. that the surface area of a parable is equal to four thirds of the surface area of a triangle of the same base) by a kind of experiment: he measured and weighed appropriate parts of a metal sheet. However, inventing theorems is something different from justifying it. Sciences are divided into aprioristic and aposterioristic ones with respect to the way of justification of their theses, and not with respect to the way of reaching them. Leverrier's hypothesis had to be empirically verified, otherwise it would have no right of citizenship in physics. Archimedes did not stop at his experiments, but the formula for calculating the surface area of a parable was finely derived from the definition of a "parable" and axioms of geometry – otherwise it would not be a geometrical thesis.

This is what Twardowski wrote about the distinction known later as the distinction between the context of discovery and the context of justification:

> It is not enough to *arrive* at new propositions that hit the mark, or to *discover* previously unknown truths; one also has to *ground* them, to show that these new assertions (propositions) are true, or at least sufficiently plausible to be accepted until more plausible ones are arrived at. [...]
>
> Hence, it is not the manner of *discovering* or finding out the truths, not the path by which the sciences arrive at new assertions, that constitutes the basis for dividing the sciences into *a priori* (rational) and *a posteriori* (empirical), but rather the manner of *grounding* them. [...] Instead of saying that the *a priori* sciences are independent of experience and the *a posteriori* are based on it, one ought to say that

> the former found their assertions without resorting to experience, whereas the latter ground theirs by appealing to experience (1923, pp. 174–175).

In every science, there are some "basic premises," *i.e.* sentences (propositions) which are not justified. In aprioristic sciences, this role is played by axioms, in aposterioristic ones – by perceptional sentences.[4]

Some methodologists say that in both, aprioristic and aposterioristic sciences, these propositions are empirical, since they are generalizations of experience. Twardowski claims that, even if it is so, it has no influence on the aprioristic character of these sciences:

> The grounding of these "ultimate" or "primitive" assumptions – insofar as this grounding is even regarded as necessary and possible – lies entirely beyond the scope and task of a given science. Consequently, the manner in which this grounding (in case of need and to the extent possible) is accomplished has no bearing at all on the manner of substantiating the assertions that in the given science follow from its assumptions. And it is this manner of substantiating its assertions that is the criterion of whether we are dealing with an *a priori* or an *a posteriori* science (1923, p. 176).

This thought by Twardowski is worth stressing, as it is rarely expressed so emphatically. It is not the task of mathematics to justify its own axioms; it is not the task of physics to justify observational sentences on which its laws are based.

2.2. *Deductive and Inductive Science*

Analogical misunderstandings occur when one erases the border between inductive and deductive sciences. One should again distinguish the way of reaching the theses of a given discipline from the way of justifying them. If we take into consideration the way of justifying theses, deduction is characteristic for aprioristic sciences and induction – for aposterioristic ones.

In aprioristic sciences, one justifies theorems by deduction, though one reaches them in different ways. In empirical sciences – one justifies theorems inductively, though one reaches them again in different ways;

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[4] Twardowski's conception of deductive and non-deductive science was analyzed by Kokoszyńska (1977). She writes *i.a.*: "Do [deductive sciences] really refer to axioms, definitions and postulates in the justification of their theorems? We would rather say […] that the ultimate method of justification is the reference to terminological *conventions*, due to which axioms and postulates become implicit definitions for the specific terms of these sciences. […] The final step in indirect justification really terminates in these sciences on axioms and postulates. Similarly, in empirical sciences observational judgments are the final element of indirect justification. Twardowski simply did not want to go further than sentences (judgments) in justification, and he did not use any other concept of justification. But this should be done if we want to see clearly the difference which he himself probably suspected (1977, p. 223).

however, inductive sciences use deduction, *i.a.*, in the procedure of verification of hypotheses.

Sometimes one says that inductive sciences "become" deductive ones upon attaining their axiomatization. Twardowski stressed the fact that such claim is not precise enough. One may, indeed, express some part of an inductive science in a "robe" of deductive system, but it is only a way of systematization of this science. Similarly, one may inductively systematize a given part of an aprioristic science. However, the way of systematization of science does not determine its character. The crucial role is played here by the method of justification.

Twardowski described the way of making science in inductive and deductive sciences as follows (1901). In inductive science one starts from a maximally detailed description of particular cases. In the second one – one puts forward a general hypothesis which explains these cases. In the third step, one derives consequences from the hypothesis. In the fourth one – one confronts these consequences with reality, by the procedure of testing. In deductive sciences, the first two steps are in fact the same. The difference appears after putting forward the hypothesis, which is not confronted with reality but justified by derivation from axioms.

2.3. *Types of Empirical Sciences*

Among empirical sciences, Twardowski distinguishes, on the one hand, natural and humanistic sciences, and, on the other hand, systematic and historical sciences (in Twardowski: empirical in strict and loose sense). Systematic sciences are based on direct experience, *i.e.* facts explained in these sciences are accessible in observation. It is quite different in historical sciences, in which explained facts are reconstructed on the base of accessible data (*i.e.* saved documents, findings *etc*.). It is worth stressing that among natural sciences there are also some systematic and some historical sciences; natural history and geology may be counted in the latter group. Also in humanistic sciences one may find historical as well as systematic elements. The former predominate in general history or history of art, the latter – in economics or sociology.

2.4. *Methodological Status of Psychology*

Special attention was paid by Twardowski to psychology, its methods, and its relation to other sciences. It is understandable, since at the time when Twardowski started his scientific career, psychology was still considered as a branch of philosophy and it was only separated during his lifetime. Moreover, in the school of Brentano, to which Twardowski belongs, descriptive

psychology was even something more than a branch of philosophy – it was its foundation.[5]

In antiquity, psychology – as a science on substantial soul – was treated as a branch of metaphysics. In modern times, psychology – as a discipline concerning psychical life – became closer to epistemology. After the "division" of philosophy into particular disciplines, psychology kept its connections to metaphysics and epistemology and settled new ones, with humanistic disciplines and natural sciences (especially with physiology).

Connections between psychology and humanistic sciences come from the fact that humanities explore psychophysical products of psychical life but without taking into account their genesis, which is crucial to psychology. As Twardowski emphasized, the domains of different sciences are sometimes mixed just because the distinction between acts and products is not realized enough. For instance, it is the reason why some philosophical disciplines – such as epistemology, ethics or aesthetics – are sometimes erroneously treated as branches of psychology. On the other hand, according to Twardowski, psychology plays the role of a supportive discipline with respect to them (and vice versa).

Psychology has a special status in comparison to natural sciences. It has much in common with empirical systematic sciences, since facts explained within psychology are accessible in observation (let us add – at least these facts which are the elements of our own psychical life). With respect to some criteria, psychology is also similar to historical sciences. Inner experiences are accessible in observation, but not in *planned* observation. At the moment when we want to observe a certain psychical process taking place in our mind – for instance the feeling of anger or the process of hearing – this process automatically disappears or at least considerably modifies and we may only analyze a memory of this process, *i.e.* a kind of historical fact. Having no possibility to conduct planned observation, psychology may make use of experiment: one may repeatedly evoke in oneself some psychical phenomena and analyze it (again – in retrospection). It happens that psychologists explore by experiments some elements of psychical life of other people; behaviorists are even convinced that psychological research should be limited to examination of external acts of people taking part in such experiments.

[5] Let us remember that Twardowski's work "O czynnościach i wytworach" ["Actions and products"] (1912) is considered as definite parting with psychologism. However, Twardowski never gave up with the view that psychology equips philosophy with its subject which he identified with objects of inner experience. *Cf.* Brandl, Woleński (1999), p. 9.

Although Twardowski considered experimental psychology to be an important part of psychology,[6] he also expressed the conviction that some elements of psychical life would never be accessible in experiments. The basis of every psychological research is introspection:

> Exploring psychical life of other beings on the basis of its manifestations, one reconstructs this life with the help of introspectively reached knowledge about our psychical life (1910).

So, there are two basic methodological difficulties in psychology: the necessity to explore psychical life of other beings and to make use of subjectively marked introspection.

3. Reasoning, Inference and Proof

Twardowski's classification of sciences was based, as it was mentioned, on his classification of reasoning. Twardowski analyzed the problem of reasoning in his *Zasadnicze pojęcia dydaktyki i logiki* [*Basic Notions of Didactics and Logic*], already in 1901. It is important to stress that Twardowski's ideas inspired many of his students who presented their own classifications of reasoning.

Twardowski defines "reasoning" as follows:

> Action with the help of which we state that there is a relation of consequence between two or between two or several propositions is called reasoning (1901, p. 29).

Further, he explains that reasoning is a process composed of two steps. In the first step, one compares propositions R_1, R_2, … R_i with a proposition C with respect to whether the truthfulness of R_1, R_2, … R_i entails the truthfulness of C, *i.e.* whether R_1, R_2, … R_i are in fact rations for C. In the second step, one states that, in fact, the truthfulness of C is necessary implied by the truthfulness of R_1, R_2, … R_i. Thus the first step consists in a certain comparison, the second – in making a certain statement (proposition).

Twardowski classifies processes of reasoning with respect to various (mainly traditional) criteria. He distinguishes (a) direct and indirect reasoning with respect to the number of reasons, (b) categorical, conditional. mediatory and mixted reasoning with respect to the form of the

[6] During the stay in Leipzig in July 1892 Twardowski took a closer look at the work of the first psychological laboratory, created by Wundt. Later, Twardowski founded the first psychological laboratory in Poland.

propositions which occur in reasoning;[7] (c) certain and probable reasoning – with respect to the level of the certainty of the proposition which asserts the occurrence of entailment between reason(s) and consequence.

In Twardowski's conceptual scheme, the concept of reasoning is distinguished from the concepts of inference and proof.[8] The reasoning is only a part of those scientific activities. In the process of reasoning, one only asserts that there is the relation of entailment between two or more propositions but does not assert any of these propositions as true. The situation is different in the case of inference and proof. In the inference, we start from propositions which are asserted as truths and we look for their consequences. In the proof, we start from a proposition which is not yet asserted and we look for true reasons for this proposition.

In the inference – reasons are called "premises" and the consequence is called "a conclusion." In the proof – reasons are called "arguments" and the consequent is called – "a thesis."

In short: by Twardowski, (a) reasoning consists in matching a reason with consequence, (b) inference consists in matching a consequence and accepting this consequence on the base of asserted reason, (c) proof – consists in matching a presumed reason and asserting a presumed consequence of the base of an asserted reason.[9]

4. Philosophical Hypotheses

As it was mentioned above, Twardowski accepted the Brentanian *credo*, which involved concerning philosophy as a science. Such a way of practicing philosophy was, according to Brentanists, possible, since philosophy does not differ from other sciences with respect to methodology: it makes

[7] Conditional propositions have a form of implication, and mediatory propositions have a form of disjunction. Categorical ones are simple or have a form of conjunction.

[8] By the way, Łukasiewicz (1911, p. 70) was not strict when he wrote that inference and proof are considered by Twardowski as *kinds* of processes of reasoning.

[9] Twardowski's idea was first developed by Łukasiewicz, who distinguished four types of mental operations. He understood inference and proof similarly to Twardowski and defined inference as matching a consequence with an asserted sentence, and proof – as matching an asserted reason with an unasserted sentence. He also distinguished two another operations: examination and explanation, and defined examination as matching an asserted consequence with an unasserted sentence and explanation – as matching a reason with an asserted sentence. Łukasiewicz's classification of types of reasoning was commented, developed or modified by Salamucha (1930), Kotarbiński (1947), Ajdukiewicz (1955) and Czeżowski (1959). All these conceptions are compared in Jadacki, Tałasiewicz and Tędziagolska (1999) and summarized in Jadacki (2003). See also Woleński (1989).

use of deduction and induction like other sciences. The inductive-deductive method is, according to Twardowski, the appropriate method of philosophical research. The first step of this research consists in putting forward hypotheses on the basis of data of inner experience. In the second step, we derive consequences from these hypotheses and in the third one – we confront these consequences with experience (1894/1895, p. 8).

Thus, the status of philosophical hypotheses is similar to those of natural sciences. We may never be absolutely sure that a given philosophical hypothesis is true: every one of them may be replaced by another, better one. From among many competitive hypotheses we choose one, which, on a given stage of development of science, seems to be the most probable.

4.1. *Philosophy of Technics*

In 1877, *Grundlagen einer Philosophie der Technik* by Ernest Kapp was published and a few years later Twardowski wrote a comprehensive review of this book. Two of Kapp's ideas were especially interesting for Twardowski: the methodological status of Kapp's law of projection of organs (*scil*. human organs into instruments constructed by people) and the consequences of this law for the mechanistic standpoint in philosophy.

Kapp's law states that all instruments are unconscious simulations of human organs. It is an inductive generalization based on analysis of how many instruments, both simple and complicated, work. According to Kapp, arms of a lever are modeled on the base of human arms, "teeth" of a saw are projections of human teeth, human eye – is a prototype for optical instruments, *etc*.

Twardowski estimates Kapp's hypothesis positively, as firmly based on many facts, but stresses that it is too far-reaching. At the same time, Twardowski reveals his anti-mechanistic position. He claims that even if Kapp's hypothesis is accurate, the mechanistic position, at least in its extreme version, is doubtful:

> Kapp is right by stressing the fact that organism is a prototype and mechanism is its reflection, so that we cannot claim that organism is only a mechanism (1896, p. 288).

According to Twardowski, mechanism (saying, in its most radical version, that organic phenomena may be fully explained by mechanistic processes) may be only considered as a methodological postulate stating that one should try to explain maximally many organic processes through appealing to physical laws. Mechanistic hypothesis should not be considered a well established hypothesis explaining a variety of organic phenomena:

> Mechanist worldview justifies its existence as the so-called heuristic principle, *i.e.* a principle which leads to explain at least one state of affairs; but this view is not a principle which explains everything by itself (1896, p. 288).

4.2. *Ethics and Evolution*

Twardowski was an absolutist in the domain of axiology, both ethics and aesthetics. In this spirit, he criticized evolutionary ethics, saying that moral norms evolve together with human evolution. An empirical fact, which is to be explained by evolutionary ethics, is that representatives of different cultures accept different ethical principles and that even principles accepted within one cultural sphere change with time. Twardowski explains the same set of facts in another way: for him, it is not the testimony of evolution of ethical norms, but of evolution (or rather maturing) of humans. Ethical truths do not change in time, but people discover them gradually. It is similar with all scientific truths, logical truths including. They are also discovered step by step.

Twardowski rejects the view that ethics does not contain any axioms, *i.e.* (here) obvious and unquestionable theses. Divergences in ethical evaluations have their source in the fact that identification of these truths, concerning moral good and evil, requires special abilities: maturity of conscience and "emotional sophistication."[10] It is very difficult to acquire such a maturity, maybe even more difficult than intellectual maturity. Thus, it is not surprising that it is easier to identify logical axioms than ethical ones.

4.3. *Materialism*

Twardowski regarded the materialistic hypothesis (which he analyzed, as we remember, already as a pupil of *Theresianum*) as worthy of special attention. He analyzed the lack of clarity in the argumentation of materialists and pointed out facts which seem to falsify their hypothesis.

In the afore mentioned book *Kraft und Stoff* Büchner formulates, *i.a.*, such versions of materialistic hypothesis: "A brain is an organ of thinking"; "Brain and thinking are directly and necessarily connected"; "Brain is the place and organ of thinking"; "There is identity between soul and brain"; "There is a necessary and indissoluble connection between brain and soul." According to Twardowski, these formulations require specification and can be expressed in one of three ways:

[10] Twardowski's view on the connection between the ethical cognition and emotional life is very similar to the Brentanian one; in Poland it was developed by Twardowski's pupils: Kazimierz Ajdukiewicz and Tadeusz Czeżowski, and later – by Marian Przełęcki. Many ethical and metaethical view of Twardowski were also took over by Tadeusz Kotarbiński in his independent ethics of trustworthy protector (a complete reconstruction of Kotarbiński's ethical views may be found in Brożek, Jadacki (2009).

(a) Psychical processes are physical ones: they are only movements of atoms.
(b) Psychical processes are products of brain processes.
(c) Psychical processes are always connected to brain processes.

Twardowski notices that version (c) is not purely materialistic view and that version (a) is obviously false, since it contradicts some basic introspective data.

Analyzing version (b), Twardowski emphasizes that every (material) cause, if it is to interact with anything, requires material substrate; however, brain cannot be the thing on which psychical processes occur, since brain is a substrate of physical processes.

Twardowski accused the supporters of the view of causal relation between physical and psychical processes of the fallacy *non causa pro causa*. According to them, one may say that the phenomenon *A* is causally connected to the phenomenon *B*, if: (a) when *A* appears, also *B* appears; (b) when *A* disappears, also *B* disappears; (c) when *A* changes, also *B* changes. Materialists claim that all these dependencies may be found between physiological and psychical processes (*e.g.* between the processes taking place in eyes and brain and the process of seeing). Twardowski stresses the fact that dependencies between these two types of phenomena are not sufficient arguments for the thesis that they are connected by causal relation, and, generally, no co-occurrence of two phenomena is enough justification of a causal connection between them. Twardowski gives the following example. Let us imagine a room with one hole, which lets the light inside. By opening the hole, the room becomes bright; by closing it – the room becomes dark; by changing the size of the hole, the amount of light changes. But we would not say that the hole or manipulations with it are the cause of light in the room; it is at most one of the conditions of the light.

In the case of version (c) of materialism – Twardowski notices that the character of the connection between two types of processes is not clear. There is no need for any connection between these processes, especially if we take into consideration simple psychical phenomena, such as impressions and observations. But it is much more difficult to find the physical counterpoint of such psychical phenomena as pride, respect, or faith. Even if science discovers such a counterpart, it will not show the type of connection between physical and psychical processes. To the question of what kind of connection this is we have to say – in Twardowski's times as well as today "*ignoramus*" (and probably also "*ignorabimus*").

Materialists are convinced that their hypothesis has a good empirical ground. In Twardowski's time, they indicated the following facts which were considered to confirm it:

(1) The physical substrate of psychical processes is usually identified with the brain or the whole nervous system. Such a "localization" of the substrate of thinking is proved by the following facts: (a) changes in psychical life are often accompanied by changes in the brain; (b) brain and intelligence develop in a parallel way and disappear in a parallel way; (c) the size (weight) of the brain is connected with psychical abilities; (d) the ratio of the mass of the brain to the mass of the whole body is bigger in human beings than in other organisms; man – as the most psychically developed being – has a relatively well developed brain; (e) more intelligent human beings have bigger brains; idiocy is usually accompanied by the degeneration of the brain.

Twardowski shows that these arguments are selected by materialists tendentiously. He recalls other facts which lead to contradictory conclusions. Firstly, some people achieve the top of their abilities at a very old age (Plato, Sophocles, Goethe). Secondly, the brains of many extraordinary people were weighed and weight of their brains was very differential, although they had similar intellectual skills. Thirdly, the ratio of the weight of brains and bodies in some mammals and birds is bigger than in human beings and at the same time these animals have very faint "intellectual abilities."

(2) Materialistic hypothesis is also to be confirmed by facts connected with the pathology of brain: (a) a damage to the brain by a bone splinter causes a change in temperament – a patient looses confidence in people and becomes distrustful, self-contained and stubborn; (b) a damage to some parts of a brain causes disappearance of some intellectual skills, *e.g.* the damage of the second frontal lobe is accompanied by a disorder of speech.

Also these arguments may be weakened by other examples taken from medicine. For instance, brains of some mentally ill people do not show any essential changes, even if the illness lasts very long. Moreover, every type of pathology of brains found in mentally ill patients may also be found in brains of completely healthy people. Some mentally ill people suddenly recover just before their deaths, despite the fact that their brains do not change in any significant way. On the other hand – Twardowski argues – it happens that people with serious damage of the brain do not suffer from any loss in their psychical life.

(3) Experiments on the brain show that every psychical process requires some time. If they were immaterial, they could be immediate. It was revealed in experiments in which human legs were stimulated by electricity: the examined person was asked to react with the left hand when the left leg was stimulated, and with the right hand when the right leg was stimulated. It was shown that if the examined person was informed about which leg is going to be stimulated, he reacted 1/10 second faster than when he was not

informed in advance. Researchers put forward a hypothesis that this additional time (1/10 s.) is needed for such processes as making the decision which hand should signalize the appearance of stimulation.

According to Twardowski, this argumentation is based on the erroneous assumption that in this additional time (1/10 s.) there occurs only a psychical process (*scil*. the act of making a decision). But Twardowski notices that this time also has to be used for the preparation and stimulation of a nerve; this nerve is already prepared when the examined person is previously informed about which leg will be stimulated.

5. Soul and Body

5.1. *Classification of Concepts of Soul*

The problem of the relation between soul and body (nowadays usually called "mind-body problem") and the question of the immortality of the soul are the oldest and the most difficult philosophical problems. They belong to the sphere of metaphysics, understood here as the most general philosophical discipline concerned with both physical and psychical processes. The problem of immortality is additionally very controversial, because it is variously connected to worldviews: religious and antireligious. For some people, the conviction about immortality is a part of unreflectively accepted religious beliefs, taken from home or church. Others accept the hypothesis of immortality as a part of irrational religious metaphysics, which cannot be accepted by any critical person. Moreover, the problem of immortality is usually joined (erroneously, as Twardowski claims) with some other philosophical problems, belonging, *e.g.*, to the domain of ethics. All of that is the reason why the problem of immortality of soul has never been satisfactorily resolved or even formulated.

The systematization of conceptions of soul is hampered because of conceptual misunderstandings. Twardowski writes:

> The expressions "monism" and "dualism" possess four different meanings, since both monism and dualism may be generic or numeric, metaphysical or phenomenalistical. Characterizing a given standpoint as monistic or dualistic one should add in what sense both of these adjectives are used. Thus, one should not only say that [*e.g.*] Leibniz's spiritualism is a metaphysical monism, but also add that it is generic monism (1965b, p. 204).

In Twardowski, one may find classifications of conceptions of soul with respect to three criteria. Firstly, these conceptions are differential – according to Twardowski – with respect to the method of resolvability

of mind-body problem: inductive (experimental), deductive and inductive-deductive one. What is interesting, Twardowski considers spiritists to be representatives of the experimental method, since their aim is to "provoke such phenomena which would justify immortality [of soul] only through the fact of their existence, without any theories" (1895a, p. 429).[11] Twardowski treats this method with reserve: too many scientists undermine the reliability of spiritualistic "séances."

The deductive method is used by those who do not appeal to empirical data and derive the resolutions of the problem of immortality from some previously accepted suppositions. As examples, Twardowski mentions the so-called ethical proof of the existence of the soul: it is to follow from the fact that man possesses an innate desire to improve (perfect) himself on the one hand, and a strong desire of justice, on the other hand. The basic defect of such an argumentation is that one derives consequences concerning immortality from suppositions of "wishful" character. The most appropriate method of analysis of the mind-body problem is the aforementioned inductive-deductive method.

Conceptions of soul and methods of justifying the thesis of immortality differ, secondly, with respect to what answers are given to the question "What is soul?." Twardowski mentions here, first of all, these standpoints which give a correcting answer to this question, *i.e.* which deny the existence of the soul. Such position is defended, *e.g.*, by Locke, Hume and Fechner. According to the latter, there is no substantial foundation of "I": a hypothesis of its existence serves only as an explanation of the fact that some psychical phenomena belong to each other.

Among the supporters of the thesis on the immortality of the soul, Twardowski mentions: materialists and idealists, monists and dualists – and monadologists. Materialists claim that the subject of psychical phenomena is something material: a brain or the whole nervous system. Idealists – being in an opposite position with respect to materialists – settle all psychical phenomena on a spiritual substrate. Monists are of the opinion that "there exists a certain substrate common to both mental and sensory phenomena" (1895a), p. 433 – *i.e.* one substance which has two aspects: physical and psychical; he counts among monists Spinoza and Eduard von Hartmann (who claim that there is one pra-substance) and Ernst Haeckel (who claim that this one pra-substance is divided into many individual beings.)

[11] Twardowski came across spiritism in Munich. Let us add, as an anecdote, that some "séances" took place in the house of count Wojciech Dzieduszycki in Jezupol, where Twardowski lived for some years as the count's personal assistant and the tutor of his children.

Dualists accept two kinds of subjects: separate for physical and separate for psychical phenomena. Twardowski distinguishes extreme dualists (such as *e.g.* Descartes) and moderate ones (*e.g.* Aristotle).

In the end, as a separate view, he mentions monadology. He characterizes monadologists as philosophers who claim that "subjects of physical processes are composed of monads as their basic, indivisible parts, which are the subject of psychical phenomena, at first unconscious, and on the higher level of development conscious ones" (1895a), p. 433; the soul, according to monadologists, is a very developed monad. Various versions of monadologies are proposed, according to Twardowski, by Leibniz, Bolzano, and Gustav Teichmüller.

Twardowski's third classification of conceptions of soul is a classification on the ground of a relation to the question of immortality. He lists here three types of views: those which cannot be combined with the immortality thesis (materialism and Haeckel's monism, conceptions of Hume and Fechner which deny the existence of soul), those from which immortality follows (monadology) and finally those from which follows neither the immortality thesis nor its contradiction (dualism, Spinoza's monism).

5.2. *The Concept and Properties of Soul*

Twardowski means by "soul" the substrate of mental (or, as we would say today, psychical) processes.

Psychical and physical phenomena are characterized by Twardowski in two steps. At first, he lists some examples of them; then he mentions characteristic features of both of them. Examples of psychical phenomena are: seeing (some shape), hearing (some sound), feeling (of warmth or coldness); comprehending (of some general concept), remembering (something), waiting (for something), planning (something), concluding, judging (having a conviction), believing and doubting, joy and sadness, emotions and anger, love and hate, fear and courage, hope and discouragement, *etc*. Examples of physical phenomena are: shape, color, sound, warmth and cold, smell, taste – independently from whether anybody thinks about them or feels them.

Various criteria of demarcation between physical and psychical phenomena were proposed, but none of them – as Twardowski stresses – is generally and unconditionally accepted. Firstly, one says that all and only physical phenomena are extensive. Secondly, it is claimed that all psychical phenomena, contrary to physical ones, are accessible for inner experience (introspection). Thirdly, no two psychical phenomena (belonging to the same subject) are simultaneous. Fourthly, all and only psychical phenomena, given in introspection, seem to belong to the same whole.

Special attention was paid by Twardowski to the problem of the unity of soul (resp. consciousness).

Unity of soul manifests itself in many phenomena belonging to the one whole. Unity of soul is not (only) a logical unity (*i.e.* it does not consist in thinking of many objects as of one object), but a real one. Twardowski declares belief in the unity of soul. Arguing for this thesis he appeals to the possibility of comparing two different psychical phenomena (similar argumentation may be found by Brentano, but Twardowski does not appeal directly to his master). The starting point of this argumentation is the fact that we are able to state the simultaneity of two phenomena – *e.g.* at the same time we see a little girl and hear her crying. In such a situation we have in fact three different phenomena: sight-impression, sound-impression and the act of comparison. Let us assume that the soul has two parts, *A* and *B*, and that *A* is responsible for seeing, whereas *B* – for hearing. What could be the subject of comparison? The comparison can be prosecuted neither by *A*, nor by *B*, if there is no connection between them. If information from *A* were transported to *B*, where comparison took place, then we would identify *B* with our soul. It would be similar if the act of comparison took place in another part of soul, namely a certain *C*. If *C* had received information from *A* and *B*, then *C* would be called a soul.

Twardowski summarizes:

> Thus we may assume that among all possible psychical phenomena there are some which compose a real unity. In each of these phenomena one recognizes – partially by inner experience, partially by retrospection – something which proves that they belong with others to the same unity (1894/1895, p. 54).

After justification of the thesis on the unity of soul – Twardowski analyzes the problem of the substrate of psychical processes. He polemizes with philosophers who deny the existence of such a substrate (Hume, Fechner, Lotze). The analysis of the concept of process leads him to the conclusion that every process requires some substrate on which it occurs (the essence of the process is a change in a certain object, *i.e.* of the substrate). Those who reject the existence of soul as a substrate of consciousness use the term "soul" inconsistently and unsteadily. For instance – despite the fact that Fechner rightly explains the genesis of the concept of soul, there is an error *non sequitur* in his argumentation: Fechner is not right in arguing that if we know the way the concept of soul appears, then soul does not exist.

Twardowski stylizes his argumentation against Fechner as a talk with "group of psychical phenomena," *scil*. with Fechner's existing equivalent of non-existent soul. One may summarize this argumentation as follows. If there were nothing what connects psychical phenomena, belonging to one

group, in the unity, *i.e.* their substrate, then memory and knowledge would be impossible. But we have memory and some knowledge about the world. Thus, the soul is not only a "group of phenomena," but their substrate:

> And the person who denies that and claims that he knows that such a substrate does not exist, contradicts himself, because the sole fact of possessing such a knowledge has as its consequence the fact that he cannot possess any knowledge (1895b, p. 472).

According to Twardowski – within an "asubstrative" view – one cannot explain the feeling of unity of consciousness/subject in time. One tries to explain this unity by the fact that consciousness is composed of an incessant sequence of acts such that each of them "emerges" from the previous one. Twardowski rejects such a hypothesis by appealing to the criterion of simplicity. The unity of consciousness is guaranteed by the existence of substrate or by the sequences of acts. But if it were a sequence of acts, then one would have to assume the existence of unconscious psychical acts, guaranteeing this continuity. Thus, the explanation of the unity of consciousness by the sequence of psychical acts is much more complicated.

One should now ask what the ontological characterization of the substrate of psychical phenomena is. To the aforementioned arguments against identifying brain with this substrate, Twardowski adds another one, in his opinion the most important: the brain is a complex object, but the substrate of psychical phenomena is something simple. Moreover, brain cells are being permanently replaced by new ones, but inner reflection tells us that the substrate of our experiences does not change in time.

5.3. *Monadology*

Problems of materialism do not concern monadology. According to this doctrine, initiated by Leibniz and revived in the 19th century by Bolzano, unextensive monads are the basic building blocks of the world. There are various types of monads which form a certain hierarchy. On the top of this hierarchy there are monads-souls, which fulfill a directive function with respect to monads-bodies. In order to agree that souls are monads, one should assume that inside the monads, there occur changes and that monads-souls are somehow connected to each other. Changes taking place in monads are certainly not chemical or organic processes (which may occur only on extensive and complex objects).

Monadology understood in such a way merges together with a special type of atomism – *scil.* Fechner's one – *i.e.* a view which characterizes atoms as unextensive objects. Combinations of atoms, *scil.* material objects, are the only extensive objects. Let us notice that one may think that some components of a bigger whole do not possess any properties of this whole. Unextensive atoms-monads do not have density, volume or any

other property of bodies composed by them. Similarly *e.g.* chemical atoms do not possess some of the properties possessed by their combinations (*e.g.* they do not have colors or melting point). One would say nowadays that Twardowski considered extensiveness to be an emergent feature of bodies. The question of whether unextensive atoms-monads, which combine bodies, may be called "material," is only a verbal question.

One of the difficulties of such a synthesis is the problem of localization of the directing monads (souls). According to Twardowski, this difficulty may be removed if we agree that no unextensive objects (monads including) may enter into relations with extensive ones. Unextensive objects are not commensurable to extensive ones with respect to localization. Thus, monad-soul cannot be a physical part of a brain. Localization of soul in the brain is only habitual and superstitious.[12]

Twardowski saw the need of the synthesis of atomism with monadology and adhered to this concept. He wrote:

> It is not only accessible and possible but also recommended to attribute psychical processes to basic, simple and unextensive parts of matter and in such a way identify atoms with monads and atomism with monadology (1894/1895, p. 169).

Twardowski also stressed the fact that monadology deals with the mind-body problem better than other concepts of soul and he suspected that it preserves more explanatory power than concurrent hypotheses:

> It is doubtless that monadology can deal with all facts mentioned here. And if we find anything that monadology cannot explain, then it is surely something which cannot be explained by any other theory – neither by materialism, nor by spiritualism, nor by dualism or monism (1894/1895, p. 170).

The most significant concurrent theory with respect to monadology, is dualism. Twardowski compares probability of monadology (in the Bolzanian sense) and dualism (in the Aristotelian sense) by the use of criteria of the scope and of simplicity. With respect to these criteria – (a) the more facts a given hypothesis explains and (b) the less additional hypotheses a given hypothesis needs, the more probable this hypothesis is; provided that the probability of a given hypothesis is determined not only by the number of additional hypotheses but also by their quality. Aristotelian dualism assumes that the monad-soul joins the embryo of the body and starts to exist in this moment; monadology assumes the preexistence of monads-souls.

[12] Twardowski compares the question of objects without localization to the question of (also not localized) relations. Two similar vessels are localized somewhere, but not their similarity. If vessels move, one may get the impression that also similarity moves, but it is only an illusion. It is worth adding that by some contemporary ontologists properties and relations are treated as localized objects.

An additional hypothesis, in the case of monadology, says that the development of an embryo may equip the soul with consciousness and memory. Dualism does not need such a hypothesis, but, on the other hand, it requires creative acts every single time the soul and the body join. In such a way additional hypotheses are difficult to measure and estimate with respect to legitimacy. The only rational way out in this situation is to prevent oneself from accepting any of these solutions.

Twardowski adhered to monadology throughout his life. Even in 1932, he wrote in his auto-description (which weathered in manuscript) that the combination of monadology and Fechner's atomism (devoid of asubstantial element) is very close to him.

6. The Problem of Immortality and Natural Sciences

Twardowski's argumentation for the immortality of soul is especially interesting as connecting premises taken from philosophy and natural sciences.

According to Twardowski, the following reasoning is accepted:

(1) Basic, simple components of matter are indestructible.
(2) Soul is a basic, simple component of matter.
———————————————————————
(3) Soul is indestructible (immortal).

The minor premise (2) of this syllogism has its source in philosophical investigations. The major premise (1) comes from natural sciences and is a certain form of the law of preservation of energy.

If monads are substrates of psychical processes, and at the same time they are basic components of matter, then these monads should come under the law of preservation of energy, which, in one of its formulations, states that basic elements of matter neither come into existence, nor are annihilated; the whole sum of them remains the same (1894/1895, p. 167 and 190).

The conclusion of these two premises is the thesis of the immortality of the soul (3). Applying the law of preservation of energy to monads, we obtain even more: not only post-existence, but also pre-existence of soul:

> What […] is eternal does have neither the beginning, nor the end in time. Soul, being eternal, is *immortal* (1895b, p. 479).

Twardowski is convinced that every consequent supporter of monadology should accept such a consequence.[13]

He also stresses that none of the premises of the analyzed syllogism is certain; both of them are only probable – so the conclusion is also only probable. Twardowski admits that the major premise is more probable (coming from natural sciences). He expresses the conviction that no stronger proof of immortality can be given – the immortality of the soul will never be shown with certitude:

> Our resolution of the problem of immortality is thus probable, not certain. No certain answer, in my opinion, can be given by science in this area. We may be only indomitably convinced about immortality because of ethical or other motives (1894/1895, p. 182).

Despite these reservations, Twardowski was convinced that his argumentation for the thesis of the immortality of the soul is accurate. He wrote:

> Let the opponents of immortality show me the error in reasoning, in a way by which I achieved the immortality thesis, instead of shouting that a soul, for such and such reasons, has to be mortal. Scientific critics should not criticize the results of research but the way of achieving it. And since this way is in this case clear, since conclusions follow in a strict logical sense from undeniable, then those for whom immortality is not convenient, shout that the soul is mortal or that there is no soul. As long as they only propose new proofs of mortality of soul and do not show the error in the proof of immortality, we will have the right not to pay attention to them. As long as nobody convinces us that we have taken the wrong way, we will believe that we did not miss the target (1895b, p. 481).

Disregarding whether Twardowski's way is in fact accurate, let us notice that two of Twardowski's suppositions are the most suspicious. Firstly, that for every x: if x is simple, then x is created by supernatural forces. Secondly, that for every x: if x is simple, then x is eternal. Considering monads as unextensive parts of matter is also difficult to combine with denying that monads are localized in space: lack of extensity does not result in the lack of localization. In consequence, the application of the law of preservation of energy to monads and souls is doubtful.[14]

Despite these difficulties, Twardowski's analysis of the mind-body problem is an original proposal of resolving the question of immortality and many of his analyses may serve as a model for contemporary investigations which take into consideration the newest results in the domain of physics, chemistry, biology and psychology.

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[13] According to Twardowski, it is natural that we do not remember our life before birth – we also do not remember fetal life and early childhood.

[14] In later manuscripts, Twardowski himself treated the application of the law of preservation of energy to reasoning on immortality with reserve.

7. Philosophy and Science: Distribution of Competences

At least for the last couple of centuries, there has been announced "the end" of philosophy, which was to be replaced by specific disciplines. Twardowski was confident about the future of philosophy. He criticized those who derive careless philosophical conclusions from scientific theses. His conviction on philosophical (over)interpretation of scientific theories is expressed concisely and emphatically in his text on evolutionary ethics:

> The whole [...] evolutionary ethics is a new testimony of how casual naturalists get when they start philosophizing; and if one needs to add another argument that philosophy justifies its existence despite the intensive development of natural sciences, which are to replace it, as the argument may serve the results of this investigation. No one denies the significant role and the high level of development of natural sciences. But in that case one needs even more philosophy, so that it does not stop propagating the old truth: *Ne sutor ultra crepidam* (1895g, p. 563).

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Mariusz Grygianiec

ON CZESŁAW LEJEWSKI'S ONTOLOGY[1]

Semantics without ontology is like a house without foundations. It collapses into a set of arbitrary injunctions and prohibitions justified by ad hoc considerations. Moreover, outside ontology reistic semantics loses its rationale.
Czesław Lejewski

1. Introduction

In contemporary philosophical literature Czesław Lejewski is frequently cited as a logician and a creative continuer of Stanisław Leśniewski's research.[2] Slightly less often he is mentioned as a critic of some Quine's theoretical efforts in relation to the notion of existence.[3] However, least likely, Lejewski is cited as an original philosopher and a defender of reism.[4]

The paper aims to highlight this last item of his intellectual creativity. In this text I am going, first, to recall the main metaphilosophical ideas of Lejewski, with particular regard to his views on ontology and metaphysics, second, to provide an outline of Lejewski's extended version of reism and some of his metaphysical inquiries, third, to examine the defensive strategy of reism used by Lejewski in connection with K. Adjukiewicz's criticism

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[2] Compare, for instance, Lejewski (1954/1955), (1955/1956), (1960), (1969), (1974), pp. 265–283.
[3] Compare, for example, Lejewski (1954), (1967), (1970).
[4] Compare, *e.g.* Lejewski (1979).

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to T. Kotarbiński's doctrine. I shall finish with an argument against reism and general assessment of Lejewski's efforts in the context of his defence of reistic ontology.

2. Ontology, Logic, Metaphysics

Lejewski's views on metaphysics and ontology were – compared to many representatives of the Lvov-Warsaw School – rather unusual. This uniqueness consisted mainly of a very friendly and optimistic treatment of these traditional areas of philosophy. Moreover, Lejewski strongly expressed his opinion that no concept that didn't include metaphysical content, merited to be called philosophical.[5]

In his inquiries into the nature of metaphysics Lejewski, in relation to "the first philosophy," mainly refers to the views of Aristotle. One of the key ideas that Lejewski seems to share with Stagirite, is the belief in the maximum generality (universality)[6] of metaphysics. Metaphysics, in terms of its subject matter, is here contrasted with other sciences: while others concentrate only on a part of what exists, it makes the effort to make the subject of its study everything that exists. This has, of course, some consequences. One of them is the circumstance that, together with an increase in the scope of the study, the content of the obtained findings decreases to a minimum: you cannot expect from a theory trying to embrace the whole of reality that it will provide very detailed descriptions of its subject matter. Lejewski, however, believed that some kind of description and explanation was possible here – it is only needed the assumption that some properties, attributes or relations, relevant to all objects, exist. It seems that Lejewski shared this type of ontological optimism with Aristotle. He claimed, *inter alia*, that metaphysical claims are simply assumed as to be true by more detailed disciplines, and the evidence for that is the fact that these domains commonly use – explicitly or implicitly – ontological terminology.[7]

The generality of metaphysics has also another, methodological consequence. This is a relative independence from empirical knowledge due to the lack of observation and experiment within metaphysics. According to Lejewski, this does not mean the absolute independence of metaphysical knowledge from empirical – in his opinion, it only proves that all you need to practice metaphysics is to appeal to the *default* empirical knowledge.

[5] See Lejewski, (1993).
[6] Compare Lejewski (1976), p. 128.
[7] Compare, *e.g.* Lejewski (1980), p. 381.

Based on the author's papers, it should be guessed that he meant some kind of *ex post* relation between metaphysical claims and theorems of scientific theories.[8]

Lejewski was convinced that, despite its generality and relative independence from empirical experience, metaphysics is able to achieve a high level of precision and exactness, which is imposed by the contemporary requirements for scientific disciplines. So Lejewski, in relation to metaphysics, was methodologically optimistic, which was expressed in his own reconstructions and ontological analyses. He was familiar with the axiomatic method, which he effectively applied both to the defence of Kotarbiński's reism and to the foundation of his own ontological system.[9] At the same time he thought that some ontological claims were simply logical in character; this included statements on identity and difference between objects.

According to Lejewski, metaphysics should provide a general description of reality. But what is the relation between metaphysics so conceived and the aforementioned ontology? It can be inferred from Lejewski's papers that ontology lies at the intersection of metaphysics and logic. Evidence for that can be Lejewski's opinion that not every ontological thesis is a metaphysical one. If there are some ontological theses which are not strictly metaphysical, then most likely they have to be a part of logic – similarly as the above mentioned theses on identity and difference.[10] It may also be thought that some ontological theses, for instance, the ones on the meanings of some concepts or those which determine formal relations between categories, are not a part of the description of reality. Such claims could be qualified as ontological, but not metaphysical. Despite this, ontology seems to be indispensable in practicing metaphysics, if it is to meet the above mentioned formal requirements. From other parts of Lejewski's

[8] In his analysis Lejewski quite often refers to empirical justifications, though, on the other hand, it must be admitted that he treats them rather loosely.

[9] With respect to the second point, compare, for example, Lejewski (1986), pp. 171–197.

[10] However, logic should not be identified with ontology. Both disciplines share a significant part of their terminology. For instance, such ontological expressions as "object," "individual," "part," "property" are expressions occurring in both fields. In turn, technical terms, such as logical functors, deduction rules, quantifiers, which are a purely formal part of the vocabulary of logic, are beyond the interest of ontology. In the already quoted text there is Lejewski's suggestion that logic is an axiomized and formalized part of ontology. Using an analogy, this relation can be recognized as follows: ontology is to logic, as the content to the form. Compare Lejewski (1980), pp. 384–385. Two further differences between logic and ontology can be brought up as follows: (i) ontology formulates some existential claims, and logic – not; (ii) ontology is an attempt to describe reality, and logic restrains from that. Also compare thereon: Lejewski (1985), pp. 10–11.

papers it can be presumed that the role of experience in justifying statements makes an additional difference between metaphysics and ontology: while ontological claims can be, even indirectly, empirically justified, the metaphysical ones do not have such support.

Lejewski agrees with the traditional view that the primary objective of ontology is to give the most general description of reality as a whole. This objective is carried out by finding an answer to the question of which categories of objects exist (and – possibly – what the relations between those categories are). An ontology postulating the existence of only one category of objects, is a unicategorial ontology. When it stipulates more than one category – it is a multicategorial ontology. Kinds of existing objects simply form categories or ontological universes. An example of a unicategorial ontology is reism, recognizing only one ontological category – the category of material objects. Platonism would be an example of a multi-categorical stance – it postulates – apart from the category of material objects – also different categories of abstract objects, such as numbers, sets, and properties. It should be added that these categories are mutually exclusive and they do not fall under any wider universe. The feature of unicategoriality or multicategoriality is not just a simple criterion for the classification of standpoints. It is also used to highlight a very interesting relation between ontology and language, more specifically – between ontological and semantic categories (and syntactic).

If we are dealing with a unicategorial ontology, within which, for instance, only one ontological universum of material objects is recognized, the corresponding functors do not exhibit ambiguity. A unicategorial ontologist, for example, does not have to worry about the ambiguity of the functor "is" in subject-predicate sentences. In the meantime, a multicategorial ontologist, saying, for instance, that "Something is a table," "Something is a prime number," "Something is an infinite set," has to deal with ambiguity of this functor. Moreover, this ambiguity has to be revealed using adequate logical constants and variables (for example, in natural language noun-expressions will not create a single semantic category).

This ambiguity, however, has to also be taken into account by a unicategorial ontologist, if he wants, for example, to negate a statement of his multicategorial opponent. Therefore, he must use the language which is adequate for a multicategorial ontology. However, in order not to weaken his own stand by using only multicategorial language, the unicategorial ontologist must be equipped with an appropriate syntax which does not involve ontological commitments. In this context, it is additionally understandable why Lejewski objected to the standard, existential interpretation of quantifiers in Quine's papers. Let me remind, that under this interpretation, the values of variables in the range of quantification have

to be admitted as existing, so long as the statements that contain them are true. The problem with this widely accepted interpretation is that some statements of logic and some rules of inference (*i.e.* the rules of universal instantiation and existential generalisation), preserving their validity in non-empty domains, lose it in the empty ones. For Lejewski this situation is highly undesirable, as it makes the applicability of the above mentioned statements and rules dependent upon empirical factors. The desire to obtain neutral syntax by a unicategorial ontologist is an additional motive to revise Quine's interpretation.

Based on Quine's interpretation the rules *dictum de omni* and *dictum de singulo* and sentences (i) $\exists x\ (Fx \vee \sim Fx)$ and (ii) $\forall x\ Fx \rightarrow \exists x\ Fx$ do not retain universal validity, this means it expires in empty domains. In order to avoid such consequence Lejewski proposes non-restrictive, non-existential reading of quantifiers ("For every *x* ...," "for some *x* ..."), within which the relevant statements take the following form:

(a) $\forall x\ (x \text{ exists} \rightarrow Fx) \rightarrow Fy$,
(b) $Fy \rightarrow \exists x\ (x \text{ exists} \wedge Fx)$,
(c) $\forall x\ (x \text{ exists} \rightarrow Fx) \equiv \sim\exists x\ (x \text{ exists} \wedge \sim Fx)$.[11]

Lejewski's interpretation makes the above statements and rules independent of any *out-of-logic* solutions. Of course, it also changes the meaning of the notion of *ontological commitment*, as quantifiers cease to play the role of its indicators.

If quantifiers are not provided with an existential import, the notion of *existence* has to find its place among predicates. Lejewski sees an opportunity to specify the meaning of the predicate of *existence* within Leśniewski's *Ontology*. For names with a singular reference the functor "$ob(x)$," and for names with a general reference – the functor "$ex(x)$" would be applied:

(i) $\forall x\ [ex(x) \equiv \exists y(y\ e\ x)]$,
(ii) $\forall x\ [ob(x) \equiv \exists y(x\ e\ y)]$.[12]

Incidentally, with the above interpretation we obtain – within the syntax of our language – the expected, partial disposal of unwanted commitments.

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[11] Compare Lejewski (1954), p. 111.

[12] These definitions are obtained in Ontology by virtue of the single axiom: $\forall a, b\ \{a\ \varepsilon\ b \exists x\ (x\ \varepsilon\ a) \wedge \forall x, y\ [(x\ \varepsilon\ a \wedge y\ \varepsilon\ a) \rightarrow x\ \varepsilon\ y] \wedge \forall x\ (x\ \varepsilon\ a \rightarrow x\ \varepsilon\ b)\}$. In the cited article Lejewski uses de facto his own idea of defining the relevant concepts by using the notion of ordinary inclusion ("$\subset$"), not – the functor "ε" (singular inclusion). However, the general sense of the finding is fully compatible with the understanding of the mentioned notions based on *Ontology*. Compare Lejewski (1954), pp. 115–118.

Of course, this does not mean that with a change of quantifiers' interpretation all ontological commitments disappear. They remain, but they have to be implemented in other way.

Returning to the questions related to the nature of metaphysics and ontology, it is worth stressing the already mentioned additional difference between them. According to Lejewski, there are such ontological statements which are confirmed or rejected by experience. The following sentences are examples of such statements: "For some *x*, *x* is a material object," "For some *x*, it is not true that *x* is a material object." However, if we take, for instance, the following sentences: "For some *x*, *x* is an abstract object," "For every *x*, it is not true that *x* is an abstract object," assertion or rejection of these sentences will not be dependent upon experience. Lejewski is willing to call these kinds of ontological statements the metaphysical one. Ontology contains some empirical and theoretical terms (for instance – respectively: "material object," "abstract object"). Realistic metaphysics in Lejewski's sense is such an ontology that (i) contains theses which are not dependent upon experience; (ii) contains theoretical terms and so-called realistic terms, *i.e.* terms defined by realistic definitions (where *definiens* comprises only – apart from logical terms – empirical terms or terms defined on the ground of empirical terms[13]). A metaphysics, containing theoretical terms, which are not defined with the aid of realistic definitions, is described by Lejewski as an idealistic metaphysics.

Lejewski's system of ontology, which is virtually an extended version of reism, consists of eight claims:

(1) There is only one ontological category, namely the category of objects.
(2) Every object is a material object, *i.e.* a thing.
(3) There are an infinite number of things (hypothesis).
(4) Everything that exists has proper parts (hypothesis).
(5) Everything that exists is extended in time – there are no instantaneous objects (hypothesis).
(6) Everything that exists is extended in space (hypothesis).
(7) Every thing is extended in time-space, which is a necessary and sufficient condition of their having proper parts (hypothesis).

[13] As an example of a theoretical term, defined on the ground of empirical terms, Lejewski gives the term *instantaneous object*. This concept is not empirical, as its possible designation has no chance to affect our senses. However, this concept can be defined with the use of other empirical terms (*i.e.*, for example *object*, *part* and *being earlier than*). Compare Lejewski (1993), pp. 22–23.

(8) The world has neither beginning nor end, and it is unlimited in space (hypothesis).

Lejewski completes these ontological claims with two semantic theses:

(9) If any sentences that directly or indirectly imply the existence of abstract objects are true, they have a metaphorical character and they are subject to paraphrase without loss of content to the statements not provided with existential meaning or to sentences implying the existence of material things only.

(10) Sentences that directly or indirectly imply the existence of abstract objects and are not subject to paraphrase in the above sense (*i.e.* they need to be understood literally), are to be rejected as false.

The above statements, especially (1)–(8), need a few comments. First, it should be noted that (3)–(8) are taken to be hypotheses in the sense that the contemporary empirical sciences cannot unambiguously determine whether any of them or their negations are true. Nevertheless, these statements should not be directly treated as hypotheses pretending to become scientific laws. With regard to (1) it is worth observing that it is in fact a combination of two statements: (i) that there are objects (for some x, x is an object); (ii) that there are no other entities than objects (there is only one ontological category – the category of objects). The second of these is an implicit rejection of multicategorial ontology. Since the rejection of the existence of such objects as numbers or classes cannot be based on experience,[14] (1) is a metaphysical thesis.

Statement (2) is inconsistent with the single-categorical Platonist's belief that abstract objects exist. If we consider as abstract objects such entities, which: (i) are objects; (ii) are not material objects, then (2) will have realistic meaning and – at the same time – the metaphysical one, as a rejection of existence of objects other than material ones is not based on experience.

Statement (3) is also a metaphysical and realistic claim, as it does not contain any idealistic terms, and the notion of *infinity* belongs to the vocabulary of logic. It is a similar situation with (4); although this statement is in fact a rejection of the belief in existence of atoms (*i.e.* objects without

[14] It is worth mentioning that in the sentences like "There is not a number," "There is not a class," "Something is an object," the copula "is" occurs in different meanings (it belongs to different semantic categories). As these meanings are not determined within realistic definitions, the meaning of (1), interestingly, is idealistic.

proper parts), the theoretical term "atom" has a realistic definition itself.[15] The same applies to (5): a rejection of the existence of instantaneous objects cannot be supported by experience, but the notion of an instantaneous object has a realistic definition.[16] The case of (6) is not different – It is an *implicite* rejection of the existence of point objects. This thesis is also metaphysical and realistic, as the notions of *extension* and *inextension* are empirical terms.

Statement (7) – apart from expressing a metaphysical belief in time-space extension – is also an implicit rejection of some types of extension, other than the above mentioned ones. Another type of extension of an object would be that it would have some parts, but (i) it would not last in time; (ii) it would not be extended in space. This rejection still has a realistic meaning, as the above determined notion of *extension of another type* has a realistic definition. (7) – assuming the rejection of other types of extension – would be put into words as follows:

(7*) For every x, for some y, [y is a proper part of $x \equiv$ (x lasts in time or x is extended in space)].

Statement (8) is a metaphysical claim. Lejewski is not convinced whether it is also a realistic statement, or – an idealistic one. This hesitation arises from the fact that, though the notion of *object's having neither beginning nor end* has a realistic definition within axioms of *Chronology*, the notion of a *spatially limited object* does not have a relevant definition.[17]

The structure of Lejewski's ontological system has a hierarchical construction. The logical basis of it is Leśniewski's *Protothetic*, as the equivalent of propositional logic (defining the meaning of basic logical functors and quantifiers). *Protothetic* – apart from rules of inference with the universal quantifier, the generalization rule for the formulation of definitions and the extensionality rule for the category of functors – additionally has two important principles: (i) the principle of bivalence; (ii) the principle of extensionality for sentences. *Protothetic* is assumed by Leśniewski's *Ontology*, which for Lejewski is another stage of description. *Ontology* arises from *Protothetic* by attaching to the latter the relevant axioms, by adapting to these axioms rules of inference and by providing new principles of

[15] For every x, x is an atom $=_{df}$ (i) x is not an object; (ii) for every y, it is not true, that y is a proper part of x.

[16] For every x, x is an instantaneous object $=_{df}$ (i) x is an object; (ii) for every y and z, if y is a proper part of x and z is a proper part of x, then it is not true, that y is earlier than z.

[17] This would require a construction of an axiomatic system of *Stereology*, which Lejewski did not formulate. However, it should be assumed, that the mentioned definition is possible in principle.

definability and extensionality. The meaning of the copula "is," the notion of *an object*, the functors "there is at least one" and "for every" are defined on the ground of *Ontology*. The basis of *Ontology* is the only axiom that was cited earlier. Within this axiom the functor "is" appears as a primitive term, but the axiom itself can be treated as its axiomatic definition. It is worth mentioning that joining to *Ontology* (3) that there are infinitely many things, makes it cease to be a purely logical system, and it becomes – a metaphysical one.

Leśniewski's *Mereology* is the third level of Lejewski's system of ontology. *Mereology* arises from *Ontology* by attaching to the latter the mereological axiom, where the term "is a part of" is a primitive one. However, *Mereology* is a purely formal system; it changes into a metaphysical theory by attaching to it both the quoted definition of atom and the thesis about the rejection of the existence of atomic objects.

Chronology and *Stereology*, which presuppose *Mereology*, are another level of the system. *Chronology*, the general theory of objects extended in time, is formed by joining to *Mereology*, appropriate axioms, definitions and two primitive terms: (i) "an object entirely earlier than another one"; (ii) "an object which lasts in time shorter than other object."[18] The rejection of the existence of instantaneous objects, which, as was mentioned earlier, is symptomatic for *Chronology*, makes it a metaphysical theory in the realistic sense. The second element of this part of Lejewski's system is *Stereology*, *i.e.* the general theory of objects extended in space. Unfortunately, Lejewski never put forward an axiomatisation for that theory. As far as I know, the only one text in the philosophical literature, which directly refers to Lejewski's ideas, is the work of Nikolay Milkov[19] from Paderborn University. But Milkov's research is not axiomatic in character and it slightly differs from original Lejewski's intuitions.

3. A Defence of Reism

Kazimierz Ajdukiewicz in his review of Kotarbiński's *Elements* formulated three basic objections to the reistic doctrine:

(A) the principal thesis of ontological reism is a truism, *i.e.* it remains a tautology on the ground of reistic language;
(B) negative theses of ontological reism are meaningless;

[18] For an attempt of an axiomatisation of Lejewski's *Chronology* compare Grygianiec (2004), pp. 111–126.
[19] Milkov (2002), pp. 518–523.

(C) it is not known what exactly it is that semantic reism asserts.

First let us start from objection (C). Ajdukiewicz[20] proposed the following four interpretations of the thesis of semantic reism:

(1) this thesis is a recommendation to regard noun-expressions which are not suitable to designate some things, as apparent names, *i.e.* onomatoids;
(2) this thesis is a statement that in everyday language the copula "is" is sometimes used in a different sense: once as a copula linking noun-expressions which are suitable to designate things, sometimes – as a copula linking noun-expressions that do not designate things;
(3) this thesis is a statement that noun-expressions suitable to designate things constitute the closed semantic category;
(4) this thesis is a postulate not to use apparent names unless they can be removed from utterances by appropriate reductive definitions.

Ajdukiewicz took a critical attitude towards the first three interpretations, while welcoming the fourth one. For according to it, semantic reism could contribute to reform philosophical language in a way that could lead to removing many pseudo-philosophical problems from it.

However, why does Ajdukiewicz criticise semantic reism in the light of the first three interpretations? Well – as to the first – Ajdukiewicz concludes that its acceptance involves simultaneous acceptance of a circular explanation of the role of the copula "is" in a sentence. The point is that in determining the conditions under which we are dealing with a proper name, we have to refer to the use of the copula "is" in its principal sense. However, characterising the principal meaning of this copula, we have to refer to its arguments (names). But this copula plays a principal role only if the mentioned arguments name some things. In effect, according to Ajdukiewicz, the whole of this argument gives the impression of circularity in explanation. This is not, admittedly, a vicious circle, but it is enough to discredit the first interpretation of semantic reism (as tautological at bottom).

With regard to the second interpretation, Ajdukiewicz claims that it is not acceptable for practical reasons. Its value (and – possibly – the status of the opposite thesis) would have to be confirmed by rigorous research of the actual use of the mentioned copula in a common language. In Ajdukiewicz's opinion, this kind of research is beyond our current cognitive abilities, so it would be better to postpone the acceptance of the interpretation in question.

[20] Compare Ajdukiewicz (1930), pp. 140–160.

The third interpretation seems to be the most interesting. According to this interpretation, if a noun-expression which designates a thing is replaced in a sentence with another expression which does not designate a thing, we will obtain a meaningless, syntactically inconsistent complex expression. However, if a similar replacement is done using proper names, the syntactic inconsistence will not arise, though – perhaps – we will have to deal with a false (but still meaningful!) sentence. According to Ajdukiewicz, to claim that a class of expressions forms a closed semantic category, one still needs to specify exactly in which language it is so. Kotarbinski seems to maintain that it is so in every language. Yet there are serious reasons not to accept such a radical interpretation. The history of formal logic shows that classifying many expressions as belonging to the same category was sometimes the cause of antinomy. On the other hand, it does not seem that, basing on a common language, to qualify different expressions to the same category (for example "a table," "pain," "death") immediately results in generating contradictions. Therefore, a limitation of the discussed interpretation to the language of reism can be considered as reasonable, but an expectation that this interpretation can be applied to any language – is an exaggeration.

The significance of Ajdukiewicz's criticism can be summarized by his own words:

> The fact that a sentence containing 'apparent names' can be replaced by the synonymous one, but containing no apparent names, proves nothing other than that (at least theoretically) we can go without apparent names (Ajdukiewicz 1930, p. 145).

Therefore, because of that, Ajdukiewicz leans to the fourth, postulative interpretation of semantic reism: avoid – if possible – onomatoids!

Lejewski essentially shares Ajdukiewicz's doubts towards semantic reism, but he also proposes some clarifications to it ((9) – (10) as above): all statements should be treated either as literal statements or as metaphors; when the latter is the case, it should be possible to paraphrase them without loss of meaning into the language in which either paraphrases will not have any existential consequences at all or in which these consequences will be limited only to material objects. Of course, under the literal interpretation a statement, suggesting the existence of objects of other categories than the category of material objects, has to be considered as false. This type of verdict is achievable by the reist only when he adapts the so-called multicategorical idealisation of language. Lejewski's attempt to defend the negative part of the ontological doctrine of reism, which I shall discuss in a moment, is a test to this kind of idealisation's abilities.

As regards objection (A), it should, in the first place, be determined what the expression "is a truism" actually means. Let me remind that the fundamental thesis of reism states that:

(R1) For some *x*, *x* is an object and for every *x*, if *x* is an object, then *x* is a thing.

Why should this thesis be regarded as a truism? Two basic interpretations here come to mind. According to the first, this thesis is a truism because on the basis of an unicategorial idealisation (here: reistic) this thesis is always true. Both the first component of it – "For some *x*, *x* is an object," and the second one, *i.e.* "For every *x*, if *x* is an object, then *x* is a thing" is trivially true. In the latter case, truth comes directly from the fact that the consequent of the above implication is always true. The second interpretation sees the triviality of reism in the fact that under Kotarbiński's language the fundamental thesis of reism is a logical consequence only of the adopted earlier definitions.

Lejewski rejects the objection of truism in both of the above interpretations. First, although the statement "For some *x*, *x* is an object" is obtained from the definition "For every *x*, *x* is an object if and only if for some *y*, *x* is *y*," but not only from it. To obtain this statement the following axiom is needed: "For some *x* and *y*, *x* is *y*." It is thus evident that even the first part of the incriminated thesis is not a definitional tautology. Secondly, and more importantly, though the statement "For every *x*, if *x* is an object, then *x* is a thing" follows from the definition "For every *x*, *x* is a thing, *i.e.* a material thing, if and only if *x* is spatial and temporal," but not only from it. To derive this thesis we still need[21]:

(a) definition: "For every *x*, *x* is an object if and only if when for some *y*, *x* is *y*";
(b) axiom: "For every *x* and *y*, if *x* is *y*, then *x* is spatial and temporal (*i.e. res extensa*) or is *x* capable of experience";
(c) axiom: "For every *x*, if *x* capable of experience, then *x* is spatial and temporal."

It can be seen again that the second part of the incriminated thesis is not a definitional tautology, and thus – the principal positive thesis of ontological reism is not, contrary to the Ajdukiewicz's opinion, a definitional tautology, either.

With regard to objection (B), it is good to remember that on the ground of reistic language the negative theses of ontological reism are meaningless.

[21] The formal proof of this thesis has been presented in Grygianiec (2004), p. 14.

This arises from the fact that the expressions like "property," "relation," "event," and "fact" are – on the basis of this language – onomatoids. When these statements are not treated literally (but metaphorically, figuratively), then they are, in Ajdukiewicz's opinion, simply false.[22]

Lejewski seeks to demonstrate that the reist does not have to use reistic language to express his ontological beliefs. He may take the so-called multicategorial idealisation of a common language,[23] within which it is acceptable to use expressions related to ontological categories other than the category of things. Lejewski argues that the power of Ajdukiewicz's objection stemmed from the identification of a theory with the language of this theory. Kotarbiński seemed to unconsciously accept Ajdukiewicz attitude towards language, and, therefore, he tried to adopt a metalinguistic interpretation of the negative part of his doctrine. Nevertheless, this identification does not need to be accepted. When this identification is rejected and the multicategorial idealisation is accepted, the substantial theses of ontological reism acquire sense.[24]

With regard to the positive part of the ontological doctrine of reism, it seems to be clear: Ajdukiewicz too quickly issued an inequitable verdict on its being a tautology. Was he also wrong about the negative part of the doctrine? In my opinion, the assessment is no longer so obvious. At first glance, Lejewski's diagnosis seems to be right. The above mentioned identification of the theory with the language and the requirement of an exceptionless use of a unicategorial idealisation are certainly too restrictive. It is also clear that adopting a multicategorial idealisation provides us with richer means of expression and allows us to articulate our ontological beliefs more precisely. However, the following question arises: how to

[22] We are confronted with a similar situation in the case of defining and denying the existence of universals. In his two papers – (1932) and (1934) – Ajdukiewicz gives a precise diagnosis of the difficulties that arise in connection with the attempts to interpret traditional philosophical problems, usually commonly formulated in the language, in which the rules of meaning, the number and nature of semantic categories are determined transparently and precisely. Adopting Kotarbiński's attitude towards language causes that a number of philosophical problems, formulated in everyday language, but paraphrased within the reistic idealisation, become meaningless, and the problems themselves – pointless. Whereas, another part cannot even be correctly formulated within this idealisation. Compare Ajdukiewicz (1932); Ajdukiewicz (1934).

[23] Here Lejewski's opinion is significant: "Now, if the multicategorical Platonist's assertions are made in terms of a multicategorical language, the same language must be used to negate those assertions, and I can see no reason why the reist should not be allowed to use it to voice his ontological views." See Lejewski (1994), p. 34.

[24] More detailed analyses, pertaining to the formulation of the negative theses of ontological reism, can be found in Grygianiec (2001), pp. 11–13, 15–17. In this context compare also: Hiż (1959), pp. 15–24; Woleński (1988), Woleński (1984).

reconcile the programme of semantic reism on the one hand and the aforementioned multicategorial idealisation – on the other? In other words: why accept the multicategorial idealisation while demanding the reistic reform of language?

Let us take a look at the following words of Lejewski:

> A proposition which appears to imply the existence of any kind of abstract entity, is either false or is meant to be a metaphor; if the latter is the case then the proposition can be rephrased, without any loss of relevant content, so as to have no existential implications or so as to imply the existence of material things only (Lejewski 1994, pp. 34–35).

Now let us confront the above opinion with the negative theses of reism, provided that the multicategorial idealisation is valid. For obvious reasons the negative theses of ontological reism cannot be treated by the reist as false – so they have to be metaphorical. As the metaphorical ones they should get – without loss of essential content – a reformulation, on the ground of which they either will have no existential implications or will imply the existence of material things only. It does not seem to me that in the case of the incriminated statements this type of reformulation is possible, at least – I have never had an opportunity to meet such a kind of paraphrase.

Therefore, I have to admit that, although Lejewski is right about the general acceptability of multicategorial idealisation by the reist, he is wrong, however, about the fact that this perspective fundamentally changes the situation of the negative theses of ontological reism. Thus, either these theses are meaningless (on the ground of the reistic language), or they are meaningful (interpreted as metaphorical statements on the ground of the multicategorial idealisation), but it can be reasonably doubted whether any prospects exist for their reistic paraphrases. Of course, the problem of the logical value of these theses on the ground of multicategorial idealisation is quite another issue, provided that they are not subject to any paraphrasing procedures. It seems to me that Ajdukiewicz was inclined to think that these claims were simply false.

From the above considerations it can be conjectured that the complete abandonment of the semantic part of his doctrine would be the most reasonable solution for an ontological reist. This would allow him to maintain the negative theses in a collision-free way. In this case determining their logical value would be blocked neither by the problem of coherence of the reistic programme, nor the efficiency of paraphrasing procedures nor any restrictions imposed by one or another idealisation of ordinary language. Lejewski's solution would work only if the reist abandoned his commitments to semantic reism. I guess he is not ready for this kind of manoeuvre.

4. An Argument Against Reism

I am not an adherent of reistic ontology and I do not think that any ontology with only one basic ontological category is able to meet our intellectual expectations with regard to the most general description of reality. I do not think that this kind of ontology is explanatorily efficient. However, in my reluctance towards reism I would not like to emphasize the so-called external motives by referring to, for example, some metaphysical beliefs, as – for instance – a belief in the existence of universals, or by pointing to some methodical considerations, such as the above mentioned reason of explanatory failure. Instead, I will mention a circumstance, already present within ontological reism, which could be a source of a serious reservation against the negative theses of the doctrine. I would also like to indicate that this reservation applies both to Kotarbiński's version of reism and to Lejewski's extended version of reistic doctrine. I would further like to note that the originator of this objection is Barry Smith.[25] I am of the opinion that the importance of the objection in question is surprisingly underestimated in Polish philosophical literature.[26]

Smith's observation is very simple. He argues namely that Kotarbiński in his text *The Fundamental Ideas of Pansomatism*[27] made a fundamental change in understanding the basic ontological category of his system. This change was based on an implicit, perhaps not entirely conscious, acceptance of the doctrine of temporal parts and it probably took place under the influence of Leśniewski,[28] who – considering the paradoxicality of some ordinary temporal utterances within the language of *Ontology* – accepted the possibility that names might also refer to the temporal phases of objects. Having accepted Leśniewski's analysis, Kotarbiński maintained that a temporal part of thing is a thing itself, for instance "a watch of the trademark *Omega* No. 3945614 from 1st January, 1934 to 31st December, 1934, inclusive."[29] For Smith, by that means Kotarbiński departed from Aristotle's understanding of the category of substances, which was still present in *Elements*.

The consequence of this change is obvious. If things are extended in time in the same way as they are extended in space, there is a major

[25] See Smith (1990), pp. 137–183.
[26] According to my knowledge, the only exception is Łukasiewicz (2009), pp. 19–31.
[27] See Kotarbiński (1935).
[28] Leśniewski (1931).
[29] See Kotarbiński (1935), p. 283. Let me add, by the way, that Lejewski rejected admittedly the existence of instantaneous objects in *time-slices* sense, but did not reject the existence of temporal parts *in toto*.

difficulty in distinguishing things from events and processes. Smith sneeringly claims that this circumstance is ironic: Kotarbiński and Lejewski deny the existence of events because of their nominalistic predilections and certain semantic reasons and then – under the influence of Leśniewski and on the ground of their materialistic intuitions – accept such a notion of thing, which *de facto* allows one to ascribe to it the connotations that are usually associated with the rejected category of events and processes.[30] The objection would therefore be the following: adopting the four-dimensional interpretation of a thing, Kotarbiński and Lejewski have no longer a reason to air negative existential claims with regard to events or processes, and at least – with regard to such kind of objects understood as concrete particulars (we have to do with this kind of understanding in Quine's or Davidson's case).

Questioning the existence of objects of these categories would be justified only if Kotarbiński and Lejewski have at their disposal a criterion which allows one to distinguish effectively – in the domain of spatio-temporal objects – things from instances of incriminated categories.[31] Neither Kotarbiński nor Lejewski formulated such a criterion. Thus, the rejection of the existence of events or processes as concrete particulars seems to remain, in light of the acceptance of the perdurantist characterisation of a thing, completely arbitrary.

5. Conclusion

Lejewski's contribution to both the philosophical tradition in general and the development of his favourite ontological doctrine is enormous. Lejewski has gone down in history not only as a logician and indefatigable continuer of Leśniewski's intellectual heritage, but also as a promoter of classically understood metaphysics and ontology. In his research he clearly showed that practicing particular branches of philosophy does not conflict with the use of advanced tools of logic. He also demonstrated how these tools can be effectively and deliberately used in dealing with philosophical problems.

Lejewski achieved a qualified success in the defence of reism. The greatest of his achievements in this regard are:

[30] Compare Smith (1990), p. 165.

[31] Moreover, even if an appropriate criterion of this type was formulated, there would still be a need of an additional justification (or: indication of the reasons) for questioning the existence of other – than things – concrete particulars.

(i) the formulation of a mature, axiomatic version of ontological reism;
(ii) the axiomatization of *Chronology*;
(iii) a clear demonstration that the principal thesis of ontological reism is not a truism;
(iv) an outline of the possibilities to express the reistic doctrine in a multi-categorical idealisation of ordinary language.

The other Lejewski's efforts may raise some concerns. As attempts of this type I would list the following:

(i) an attempt to interpret the negative theses of ontological reism within the multicategorial precisification (while allowing that the relevant statements do not have adequate reistic paraphrases);
(ii) an implicit acceptance of the theory of temporal parts, which results in undermining the legitimacy of denying the existence of events and processes.

It is regrettable that Lejewski did not manage to make an attempt to axiomatise the general theory of objects extended in space, *i.e. Stereology.*[32] Perhaps one day someone will want to make this effort as its originator started.

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[32] Barry Smith mentions in the cited article (footnote 18) that Lejewski was also taking into account the possibility of formulating of *Colourology*, *i.e.* the theory of colourful objects, which could be obtained from *Mereology* by addition of certain extra-logical constant terms, for example, expressions such as "red," "blue," and the binary predicate "*x* is the same colour as *y*." Compare Smith (1990), p. 143.

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ON TADEUSZ KOTARBIŃSKI'S REISM AND THE PRAXIOLOGICAL THEORY OF ACTION[1]

1. Ontological Reism and Semantic Reism

By following Ajdukiewicz's train of thought, let us distinguish between two versions of reism (also called 'concretism'), *i.e.* ontological reism and semantic reism (Ajdukiewicz 1930). The thesis of ontological reism can be defined as a certain ontological claim about the world according to which only things exist. The semantic thesis of reism is not a statement about the world, but about the language that we use to describe this world. According to semantic reists, we assert something only about things in the sentences in their ultimate formulations – "in reality" we only talk about things (*cf.* Przełęcki 1984, pp. 5–6). The thesis of semantic reism can also be formulated as follows: it is not so much that we *state* something only about things, but that we *should* state something only about things in our ultimate statements. In other words, our statements should not imply that we talk about something other than things. And this, in consequence, harmonises with the requirement that the so-called *apparent names* (or onomatoids, pseudo-names), *i.e.* expressions that do not refer to things (the names of abstract objects – sets, states of affairs, events, processes, properties, relations, *etc*.) should be removed from the statements that we

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produce. This short characterisation will be followed by a detailed analysis of the doctrine of reism in both of the above-mentioned versions.

1.1. *Thesis of Ontological Reism*

The doctrine of ontological reism is based on the following theses (see Kotarbiński 1993a, p. 132):

(1) All objects are things.
(2) No object is a property or relation or event or any of the other alleged objects belonging to an ontological category other than the category of things.

The ontological version of reism can be regarded as an answer to the question of what exists. According to ontological reists, it is only things or persons that exist. In other words, this thesis says that the category of things (which has traditionally been called a category of substance – see Kotarbiński 1993b, p. 155) is the only ontological category that is non-empty. However, the claim that every object is a thing needs to be commented on. This is because doubts arise as to how we should understand the terms 'thing,' 'object' and 'to exist.'

As Kotarbiński put it, the expression '*A* exists' should be understood – in accordance with Leśniewski's ontology[2] – in the following way: "for a certain *x*, *x* is *A*," "some object is *A*," "certain individuals are *A*," and "something is *A*" (see Kotarbiński 1993b, p. 153). In particular, this does not mean that if something exists then it exists at present – an inhabitant of the earth from the year 1000 exists in the same sense as an inhabitant of the earth from 2015 and 2020 (see Kotarbiński 1993c, p. 142). Kotarbiński uses the term 'object' as the most general name and this term should be treated as a synonym of the terms: 'being,' 'individual,' 'something' or 'entity':

> Should a person further ask about the definition of the term "object," we should have to refer to the meaning of the copula "is" in singular empirical statements (such as "this is green," with an indication of a leaf; or "the Earth is spherical"; or "I am gay"; or "Peter is a carpenter") and say that only that, and all that, is an object about which we may meaningfully formulate a singular sentence (of the type "*A* is *B*") with the copula so understood (Kotarbiński 1966, p. 424; orig. 1993b, p. 153).

As for the meaning of the term 'thing,' Kotarbiński uses this word with reference to everything that is temporal, spatial and physically defined:

[2] Jan Woleński writes about the connections between reism and S. Leśniewski's ontology in: Woleński 1984.

> The term "object" is defined under the assumption that it is the most general name, which is extensionally equivalent to the following description: "an object located in time and space, and having certain physical characteristics." If necessary, it may be explained once more that, of course, that nouns "time," "space" and "characteristics" are here onomatoids: "located in time" means "being somewhat," "located in space" means "being somewhere," and "having physical characteristics" means "being physically such and such" (Kotarbiński 1966, p. 434; orig. 1993d, p. 201).

It is worth noting that Kotarbiński does not refer to the concept of *matter*, which is too ambiguous in his opinion, to precisely characterise his position (*cf.* Kotarbiński 1993e, pp. 121–122). If the distinction between the terms 'object' and 'thing' is made in the above-mentioned way, this guarantees that the thesis of reism will not be analytically true (Kotarbiński 1993a, p. 133). According to ontological reists, it is only things that exist because it is only true of things that certain objects are things. In other words, each designatum of the most general name 'object' is a thing.

For Kotarbiński, 'thing' can also be defined as 'body or person (or soul),' and the conjunction 'or' acts as a symbol of non-exclusive disjunction (therefore, reists accept the existence of an object that is both a body and a soul). The term 'body' should be understood as meaning 'something corporeal' ('corporeal' means 'spatial, temporal and resistant' or 'an object that is extended and inert'), whereas the term 'person' ('soul') is equivalent to the expression 'something that is sentient,' *i.e.* it refers to a thing that feels, desires, perceives and thinks (Kotarbiński 1993a, p. 133 and Kotarbiński 1993c, p. 139). Therefore, in the light of reism, it is possible to take the following approaches:

(a) *pansomatism* – only bodies exist (which means that every soul is a certain body);
(b) *dualism* – two different kinds of objects exist, *i.e.* souls and bodies;
(c) *spiritual monism* – only persons (regared as mental objects) exist.

Kotarbiński himself – as he clearly stated in his writings – subscribed to pansomatism:

> If we assume that every sentient object is extended and inert (...), *i.e.* that every soul is a certain body, and if we accept the thesis of reism, then we obtain such a form of materialism that can be called pansomatism: the thesis that every object is a body (Kotarbinski 1993f, p. 135, translation mine).

The second thesis which the conception of ontological reism is based on, according to which no object is a property, relation, event or an object belonging to an ontological category other than the category of things, also needs to be commented on. Kotarbiński raised his first doubts about the existence of objects other than things in a treatise on ideal objects (Kotarbiński 1993g), in which he supported the position of nominalism

with regard to universals and presented various arguments in favour of the non-existence of properties, relations, events, facts, sets and immanent images. According to the arguments developed by Kotarbiński, if one accepts that objects other than things (in particular, abstract concepts) exist, this leads to many antinomies which one can avoid by subscribing to – as Quine would put it – the idea of an ontological desert landscape:

> And whoever believes in relations should try to deal with the following antinomy. Let us consider any object *A* and relation *S* that is defined as a relation between every relation *R* and object *A* which exists always and only if there is no relation *R* between this relation *R* and object *A*. Let us now ask whether there exists relation *S* between relation *R* and object *A*? Obviously, if there is relation *S* between relation *S* and object *A* then there is no relation *S* between relation *S* and object *A*, and the other way round. There is a contradiction in both of these cases (Kotarbiński 1993g, p. 106, translation mine).

Moreover, Kotarbiński considers non-reistic expressions such as "properties inher in things" or "things have properties" to be very metaphorical. While we can relatively easily state how such expressions should not be understood (Kotarbiński humorously points out that things definitely do not have built-in properties in the same way in which, for example, a room "has a built-in cupboard"), it is incredibly difficult to decide how such statements should be interpreted (Kotarbiński 1993d, p. 196). An analysis of the deep structure of different kinds of utterances leads to the conclusion that, in principle, we only seem to talk about properties and that, in reality, we formulate statements about things. When we say that snow is white, we do not intend to say anything about two separate objects (*i.e.* snow and whiteness) or the relation of exemplification that exists between these objects, but we mean that snow is such and such (*i.e.* that it can be characterised in some way), in particular – white. Therefore, as we can see, the negation of the existence of properties or relations by no means leads one to state that things are not such and such (*i.e.* cannot be characterised in some way) and that nothing "happens" to them or they do not change:

> By rejecting "the existence of properties, relations, and facts" and so on, we by no means deny that things are such and such, that things are so and so with regard to other things, or that things change in such and such a way (in particular that sentient individuals act). Indeed, we agree, of course, that billiard balls are round, that the earth is larger than the moon, that iron rods rust; we only do not agree that there exists "the roundness of billiard balls," that a certain object is "the relation of being larger holding between the earth and the moon," that something is "the fact of iron rods rusting" (Kotarbiński 1955b, p. 492, orig. 1993c, p. 142).

As we can see, Kotarbiński believes that the names of properties, relations, events or states of affairs are not names of anything. If we want to explain to someone the meaning of a statement which contains expressions

that do not refer to things, we finally obtain statements that do not contain such expressions (for example, we paraphrase the sentence "John is bursting with joy" as: "John is overjoyed," the sentence: "There is a relation of seniority between John and Peter" as "John is older than Peter," and the sentence "Whiteness inheres in snow" as "Snow is white"). Then "we may [...] presume that this is always so" (Kotarbiński 1993d, p. 202). This is a "naively intuitive and ordinarily inductive" justification of reism. Let us note that this justification refers to certain facts that are linguistic in character. This observation may serve as a starting point for an analysis of a different, "semantic" version of reism.

1.2. *Thesis of Semantic Reism*

According to the thesis of semantic reism, any names that are not concrete names should be removed from ultimate formulations and hence from statements that explain the meaning of words. A 'concrete name' (which is also called 'a proper name' or 'a genuine name') should be understood as a name of a concrete object, *i.e.* person or thing. In accordance with the semantic version of reism, all concrete names may occur both as a subject and a predicative expression in sentences such as "*A* is *B*." Kotarbiński calls expressions that do not refer to things 'apparent names,' 'pseudo-names,' 'onomatoids' or 'hypostases.' Phrases that imply the existence of properties, relations, *etc*. should only be used if this is justified by the economy of style and one should be aware of the fact that such phrases are produced as abbreviations and substitutes (see Kotarbiński 1990).

As Marian Przełęcki rightly observes (1984, pp. 6–9), the semantic version of reism is presented in Kotarbiński's writings in the form of several logically non-equivalent expressions, such as:

(1) Every statement about entities other than things is only true if it is reducible to a statement about things.
(2) Every statement about entities other than things is only meaningful if it is reducible to a statement about things.

A "non-reistic sentence" is a sentence that formally entails the existence of objects other than things. Therefore, according to thesis (1), every *meaningful* non-reistic sentence (*e.g.* "A red colour inheres in an apple") can be paraphrased into a certain reistic sentence ("An apple is red"). Thesis (2) is weaker than thesis (1) This thesis says that the possibility of paraphrasing a non-reistic sentence into a certain reistic sentence is a necessary condition of the *truth* (and not meaningfulness) of this sentence. The ontological thesis of reism justifies the adoption of the directive according

to which any names that are not concrete names should be removed from one's ultimate statements.

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Having carefully analysed the objections that were raised to reism,[3] Kotarbiński decided to ease his position, which then turned into a certain programme and (a less strict) semantic postulate:

> But experienced and reasonable people advise us to distinguish between risky suppositions and well founded theorems. Their advice, whether we like or not, must be taken into consideration, and therefore we must state as follows: in its mature form, concretism absolutely insists on its programme only. It announces that with maximum vigor it will try everywhere to eliminate apparent terms (onomatoids). It builds its hopes on its, doubtless partial, successes, and its hopes are far-reaching – they are hoping for complete success in the future. Hope is neither a statement nor a certainty, and it may be that it nourishes even if the soothsayers' prediction are unfavorable (Kotarbiński 1966, p. 435, orig. 1993d, p. 202).

This programme is aimed to thoroughly "dehypostasise" the humanities and turn the humanities into a discipline in which a clear and simpler – though perhaps less "lofty" and "deep" – but intelligible language is used (see Kotarbiński 1993k). But is this really a proposal that will be able to achieve "success in the future," in accordance with Kotarbiński's wishes? It seems that there are serious arguments for answering this question in the negative. As I will try to show in the second part of this article, after an attempt at reconciling the doctrine of reism with Kotarbiński's agency

[3] Kazimierz Ajdukiewicz's argumentation is one of the most important objections raised against reism. As he conclusively showed, one of the theses that the thesis of ontological reism is based on, *i.e.* "No object is a property, relation or event," is simply meaningless in the light of this approach (if one assumes that it is literal) or evidently false (if one assumes that it is metaphorical). Therefore, when a reist states that properties do not exist, he/she does not produce any meaningful sentence because this statement contains apparent names (let us add that the negation of nonsense is nonsense itself). In the light of reism a non-reistic thesis would be equally meaningless ("Relations exist" and "Properties exist") because it would also contain pseudo-names. Ajdukiewicz rightly evaluated this reasoning by stating that "a reist has some opinion of reality, which he cannot meaningfully state" (Ajdukiewicz 1930, p. 146). I believe that this somewhat devastating argumentation can be made even more overwhelming. If we assume that we think in language (we do not even have to assume that we only think through language; we can simply assume that our thinking "usually" takes such a form – especially because one thinks about reism in language), then we can say that a reist is not only unable to express what he/she thinks about reality in a meaningful way, but also that he/she cannot even have beliefs about reality that would make sense. Therefore, a reist cannot even *think* that properties, relations or sets do not exist.

theory and the conception of an elementary action is made, many doubts arise as to whether this programme can be successful.

2. Reism and Kotarbiński's Theory of Agency

The aim of this part of the article is therefore to characterise the agency theory that was developed by Kotarbiński in the context of the doctrine of reism that he postulated. I will try to identify those elements of Kotarbiński's concept of agency whose consistency with concretist ontology and semantics is seriously doubted.

In order to reconstruct the ontology of action, which is the basis of Tadeusz Kotarbiński's praxiology, let us look at the paradigmatic examples of *actions* that he gave. An analysis of these examples will help in elaborating the basic intuitions about this concept. Kotarbiński wrote:

> THE POINTSMAN moved the lever and the rails shifted sideways. The button was pressed and the lift started to move. The piano key was struck, and the sound was heard. What common and essential elements can be noticed in all these cases? First of all, some DELIBERATE EXERTION OF PRESSURE on a thing – in the cases given, on the lever, the button, the key. Further, some SUBSEQUENT EVENT: that something which happened to some thing (since men are things, too): to the rails, the lift, the listener. Finally, the CAUSAL BOND: the subsequent event was an EFFECT of the pressure and, consequently, that antecedent pressure was a cause of that subsequent event (Kotarbiński 1995, p. 20; orig. 1955a, p. 25).

Based on the above quotation it is possible to indicate the most important "elements" of Kotarbiński's concept of an *elementary action*. These are:

(i) the concept of an agent;
(ii) the concept of a free impulse (deliberate exertion of pressure);
(iii) the concept of a result (effect) of an action;
(iv) the concept of the causal relation between agent's exertion of pressure and some event which was caused by this exertion.

The text below presents an explication and analysis of particular concepts with regard to their consistency with the doctrine of reism.

2.1. *The Concepts of an Agent and a Free Impulse*

A reistic analysis of the concept of a *free impulse*, which is crucial to the conception of an elementary action, represents a serious challenge. Kotarbiński wrote:

> The agent of an event is he whose free impulse is the cause of that event. Shifting a lever, pushing a button, striking a piano key – all these are examples of free impulses

> – in those particular cases, we may also say, free pressures. But I prefer the term "impulse" since it better covers those simple acts in which the behavior of the agent, in some respect that is important to the given case, does not […] consist in any muscular exertion, such as when one makes an effort to recollect a forgotten name […] (Kotarbiński 1995, pp. 25–26; orig. 1955a, p. 30).

A free impulse[4] can also be called 'free (deliberate) behaviour' (Kotarbiński 1999a, p. 104). This impulse can be either "external" or "internal." The latter involves a certain mental act, for example, an act of making an internal "effort" or focusing on something, *etc*., which we know from introspection. Actions are not only a matter of tensing one's muscles and moving one's body, but they also encompass purely mental acts (*e.g.* mental calculation). Thus, a free impulse can take two basic forms: (a) of a deliberate exertion of pressure, for example, when one is moulding something with one's hands; or (b) of making a mental effort and focusing one's attention on something (Kotarbiński 1999b, p. 375). A free impulse does not always entail exerting pressure by tensing one's muscles (like, *e.g.* when John is throwing a stone); sometimes the action that one performs involves releasing this pressure, *i.e.* exerting a somewhat "negative pressure" (like, *e.g.* when John is letting go of a kite rope).

Let us note that the term 'agent' can be considered an example of a genuine name because it refers to a certain object (person) that behaves in a particular way. However, the term 'free impulse,' which is understood as an agent's 'free behaviour,' definitely is an apparent name, which refers to a certain event. Therefore, according to the assumptions of semantic reism, it should be replaced with a proper name which would directly refer to a thing and which would not formally obligate us to accept the existence of abstract entities. Let us now make a proper (partial) reistic paraphrase ("free behaviour" – "a body that behaves freely"; "an event" – "a thing"):

(*Sentence*$_1$) The agent of an event is he whose free impulse is a cause of that event (Kotarbiński 1995, p. 25).

(*Paraphrase*$_1$) The agent of a given thing is he/she whose body, which behaves freely, is the cause[5] of this thing.

Let us also notice that such a paraphrase does not allow one to differentiate between the concepts of an agent and free impulse since, in accordance with Kotarbiński's pansomatism, every person is identified with a

[4] That an impulse was *free* means that the agent *intended* to exert a given kind of pressure (Kotarbiński 1999i, p. 265).

[5] Obviously, the term 'cause' is an onomatoid, which also needs to be replaced with a certain genuine name. The complicated procedure for "dehypostasising" statements about a causal relation will be analysed later in the article.

certain body (and therefore, in particular with a body that behaves freely). Let us illustrate this thought by using the following example: when John is pushing a button and this causes a lift to move, then – as Kotarbiński put it – John is the agent, whereas the act of pushing a button is a certain free impulse (Kotarbiński 1955a, pp. 25; 30). However, the act of "pushing a button" is a certain onomatoid, which should be replaced with a name referring to a thing (more precisely, to an agent, to which we can attribute freedom of behaviour, rather than, *e.g.* to a button). Given the above, it is John, who is pushing the button, that should be regarded both as an agent and a free impulse. This conclusion seems to be counter-intuitive because it undermines the reasonableness of the distinction made by Kotarbiński.

2.2. *Reism and a Causal Relation*

The first basic difficulty that one faces when trying to determine the extent to which the concept of a causal relation is consistent with reism is the fact that Kotarbiński explicitly speaks in terms of event causation in his writings. For example:

> Finally, the CAUSAL BOND: the subsequent event was an EFFECT of the pressure and, consequently, that antecedent pressure was a cause of that subsequent event (Kotarbiński 1995, p. 20).

> The event *B* is an effect of an earlier change *A*, that filled the moment *T*, and the change *A* is the cause of the event *B*, if and only if the change *A* is an essential element of a sufficient condition of the event *B* with respect to the moment *T* and with respect to some natural regularity in the sequence of events (Kotarbiński 1995, p. 20; orig. 1955a, p. 27).

It is impossible not to notice that the literal meaning of the above expressions entails the existence of events, relations ("bonds"), states of affairs ("the fact that") and sets, which do not exist in light of concretist ontology. Moreover, Kotarbiński – as can be seen from the above examples – explicitly presents his conception of causation in terms of event causation. According to this theory, it is certain events rather than things that are relata of a causal relation. Donald Davidson, the author of a famous argument supporting the thesis that events exist and are objects that are irreducible to other objects, was one of the most well-known proponents of such an approach to causation (Davidson 1980). According to the linguistic argument that Davidson proposed, a proper analysis of causal sentences requires quantification over events, whereas – in accordance with Quine's concept of ontological commitment – the objects over which we quantify should be regarded as existing. It is obvious that the concept of event causation cannot be reconciled with the thesis of ontological reism. What is more, the thesis of ontological reism is also inconsistent with another

theory of causation, *i.e.* that of agent causation, which is currently being developed, for example, by E.J. Lowe (2008). According to these theories, it is not events, but a person (agent) and a certain event that has been caused by an agent that are relata of causal relations. The proponents of this approach consider a person as such rather than another event to be the cause of a certain event. A causal relation is presented as a heterogeneous relation between objects that belong to different ontological categories. Let us note that, although this conception may be more consistent with reistic intuitions than the theory of event causation (since it is a person, and therefore a certain thing, that is presented as having causal powers), it also cannot in fact be reconciled with reistic ontology because it introduces events that have been caused by an agent. Therefore, the only theory of causation that would be acceptable in light of ontological reism would be a conception which is Aristotelian in nature and according to which there are only things that causally interact and influence one another.[6] (Incidentally, however, is seems incorrect to say that things would be relata of a causal relation in accordance with such a conception of causation because reists do not accept the existence of relations at all).

Given the above, let us now analyse the fragments of Kotarbiński's writings that were cited at the beginning in light of the thesis (or programme) of semantic reism. First, let us note that these passages are full of onomatoids ('event,' 'causal bond,' 'cause,' 'result,' 'change,' 'sufficient condition,' 'essential element,' 'natural regularity,' *etc*.). In fact, there is only one [sic] proper name among them ('body'). This definitely does not make it easier to evaluate the above-mentioned expressions with regard to their meaningfulness (this is because we should remember that, according to a certain version of semantic reism, any meaningful non-reistic sentence should be translatable into a certain reistic sentence) and is basically inconsistent with the requirement that apparent names should be eliminated whenever possible. Moreover, when Kotarbiński himself presents his own concept of causation by using various examples, he clearly distinguishes between expressions referring to things and those referring to events:

> For instance, a grain of pollen falls on the stigma of the pistil and a ripe fruit is formed there after a period of time. We say, again, that the contact (A) of the pollen (x) with the pistil (C), which took place at a certain period of time (t_A), was the cause of the forming (B) of the fruit (D) during the time (t_B) filled by that process (and that B was the effect of A), because a certain set of events simultaneous with the contact of the pollen with the pistil, a set which included that contact as its essential element,

[6] The statement saying that the lighting of a fire in a forest was the cause of a forest fire should (probably) be paraphrased as: "The forest fire broke out because someone had set fire to wood planks."

> determined the subsequent formation of the fruit in virtue of the embryology of floriferous plants (Kotarbiński 1960, p. 319).

Thus, as we can see, Kotarbiński explicitly differentiates between certain events ("contact (*A*)" or "forming (*B*)") and things ("pollen (*x*)," "pistil (*C*)," or "fruit (*D*)"). Like the previously quoted fragments, this passage also contains many onomatoids ('event,' 'cause,' 'essential element,' 'time,' 'process,' 'set,' 'embryology,' *etc*.).

2.3. *An Idea For a Reistic Paraphrase*

Given the above, let us try to paraphrase such statements in accordance with the assumptions of semantic reism. Kotarbiński himself came up with a certain suggestion about how to a paraphrase the term 'fact' in the spirit of reism (in certain contexts this term can be regarded as a synonym of the term 'event') since he wrote:

> The fact that John was sick yesterday at noon means that John was sick yesterday at noon. In short, one can do without using the term 'fact' in exact statements if one prefers to compromise accuracy in order to avoid being accused that in his/her opinion certain objects are facts (Kotarbiński 1999a, p. 105, translation mine).

Let us therefore try to construct the possible reistic paraphrases (*P*) of the concept of a cause with the proviso that the proposal will make no claims to be complete:

> (S_2) If a blast of wind blows off a tile, which then breaks a window, this blast should be regarded as the cause of why the window was broken because, when seen from the perspective of the natural laws of mechanics, this blast, which occurred in the presence of conditions such as the shape of the roof and other parts of the building's structure, *etc*., had to lead to breaking the window. Consequently, if there had been no gust of wind the window would not have been broken (Kotarbiński 2003, p. 239, translation mine).

The above passage contains many apparent names, *i.e.* 'blast,' 'gust,' 'wind,' 'cause,' 'breaking,' 'laws of mechanics,' 'conditions,' 'shape,' and 'structure,' which I will try to replace with the appropriate genuine names:

(P_2) If moving air blows off a tile, which breaks a window, then the moving air should be regarded as the CAUSE of the broken window because, if the air moved, the roof was physically such and such (*i.e.* could be characterised in physical terms) and the building was physically such and such (*i.e.* could be characterised in physical terms), then the window had to be broken. If the air had not moved then the window would not have been broken.

I have chosen the expression 'the moving air' as an equivalent of the term 'wind' even though one can hardly regard air as a kind of body, given

the specific understanding of the term ‘body’ (something that is ‘resistant’). Additionally, let us note that this paraphrase still contains onomatoids (‘cause’), which impels us to regard this statement as nonsensical (since the structure of the definition of the term ‘cause’ is as follows: “*x* is a cause when…,” “a cause is…,” “if something is a cause then this something…,” *etc*.). Therefore, in order to get rid of the pseudo-name ‘cause’, we must make use of, for example, the following paraphrase:

(P_2*) If moving air blew off a tile, which broke a window, then this window was broken BECAUSE the air had moved. This is because if the air moved, and the roof was physically such and such (*i.e.* could be characterised in physical terms) and the building was physically such and such (*i.e.* could be characterised in physical terms), then the window had to be broken. If the air had not moved then the window would not have been broken.

The evaluation of the accuracy of the above paraphrase is an open issue. What is most important, is that Kotarbiński himself did not provide such a paraphrase, which is why we cannot say to what extent it reflects this philosopher’s intuitions about the concept of a cause.

Thus, let us take a look at other expressions:

(S_3) Finally, the CAUSAL BOND: the subsequent event was an EFFECT of the pressure and, consequently, that antecedent pressure was a cause of that subsequent event.

(P_3) When one thing (which is antecedent to another thing) exerts pressure on another thing (which is subsequent to this thing) then the subsequent thing is a result of the antecedent thing, whereas the antecedent thing is the cause of the subsequent thing.

As can be seen, the “dehypostasising” procedure is not a trivial matter. In the above example, the basic difficulty – firstly – lies in how to adequately paraphrase the word ‘pressure’ (*i.e.* “when one thing exerts pressure on another thing” or “if one thing exerts pressure on another thing”). What is more, let us also note that one might raise various objections to the name ‘antecedent’ when it is recognised as a genuine name.[7] Secondly, this paraphrase did not let us eliminate the onomatoids ‘cause’ and ‘effect,’

[7] As Z. Augustynek shows (Augustynek 1975, p. 20), in light of the conception of reism, time that is understood as an object, *i.e.* like a body, does not exist (time which is a centre in which bodies are arranged in a temporal way). For reists, things are ordered exclusively in a temporal way, *i.e.* if there are two things, one of them is antecedent or subsequent to, or simultaneous with the other. However, many difficulties arise when we try to give an answer to the question: What is time when it is understood in a non-Newtonian way?

which are crucial to the conception of causation. Perhaps the following translation into the language of reism would be more adequate:

(P_3*) When one thing (*i.e.* thing$_1$ which is antecedent to thing$_2$) exerts pressure on another thing (*i.e.* thing$_2$ which is subsequent to thing$_1$), then the antecedent thing results in the subsequent thing; whereas the subsequent thing occurs because the antecedent thing has occurred.

Things (pun intended) are even more difficult when one analyses the following excerpt from Kotarbiński's writings:

(S_4) The event *B* is an effect of an earlier change *A*, that filled the moment *T*, and the change *A* is the cause of the event *B*, if and only if the change *A* is an essential element of a sufficient condition of the event *B* with respect to the moment *T* and with respect to some natural regularity in the sequence of events.

(P_4) Thing *B* is such and such (*i.e.* can be characterised in some way) because thing *A* has changed in some way, and the changed thing *A* causes (?) thing *B* (results in thing *B*) always and only if the antecedent, changing thing *A* is necessary if other things *D* together with thing *A* are to be sufficient for a subsequent thing *B* to occur because thing *B* occurs always when things *D* occur together with thing *A* (if thing *A* did not occur together with things *D* then thing *B* would not occur either).[8]

It is by no means easy to make a reistic paraphrase of statements about a causal relation (which can be seen, for example, from paraphrase P_4) and there are many doubts about the adequacy, intelligibility and usefulness of such a paraphrase. Most of all, however, the analysis presented above provides overwhelming evidence that Kotarbiński was not faithful to the assumptions of the reistic doctrine he had developed since he himself very

[8] A certain law ("natural regularity in the sequence of events") connects an arrangement of simultaneous events with a certain subsequent event. Kotarbiński calls the arrangement of antecedent events a *sufficient condition* for a subsequent event to occur due to this law and the time period that is filled by all of the events that are components of this arrangement. For Kotarbiński an *essential element* of a sufficient condition is such a component event of this condition without which the arrangement of the other component events would not be a sufficient condition. For example, a set of circumstances surrounding the act of turning on an electric lamp switch along with the very act of turning the switch on is a sufficient condition for the lamp to become switched on (the act of turning the switch on is an essential element of a sufficient condition, whereas, for example, the fact that the switch is shimmering is an unessential element of a sufficient condition). See Kotarbiński (1955), pp. 27–28.

often used language which can serve as an example of a structure that is almost exclusively based on hypostases.

2.4. *Concept of a Result*

The fact that a result (*i.e.* that which has been caused by a certain agent) is explicitly presented as a certain event and not as a thing in Kotarbiński's concept of action is an extremely important problem as far as the reistic meaning of this concept is concerned.

> 'Result' is meant here to be all effects of a cause consisting in a free impulse, and an effect is always an event […] to formulate a theory of effective action and to impart precision to current concepts, frequently so vague, I intend to limit here the comprehensive extension of the term "result" and never to call any physical body a result, reserving for the latter such terms as "product" and "work" […] (Kotarbiński 1995, p. 35; orig. 1955a, p. 37).

Therefore, as can be seen from the quoted passage, the very fact that a product and a result belong to two different ontological categories is the criterion for differentiating between them. Thus, this distinction is a flagrant violation of the assumptions of ontological reism because results, which are events, simply do not exist – as a consistent reist would state (although products, which are things, do exist). Moreover, the distinction between results and products also cannot be reconciled with the semantic version of reism. This is because Kotarbiński coins a term and he assumes in advance that this term cannot refer to any thing. Kotarbiński's statement that was quoted above should therefore be regarded as meaningless unless we consider 'result' to be a synonym of 'product' (but then we will completely miss what Kotarbiński himself intended to point out by making this distinction).

Kotarbiński also tries to clarify the concept of a result by using the following example: "John cracked a nut with a nutcracker" (Kotarbiński 1999d, pp. 141–142). A result should be understood as any state of affairs[9] (the so-called *static result*) or event (the so-called *kinetic result*) that occurred as a result of an agent's impulse. In this specific case, this will be, for example, the fact that the nutshell cracked and that crumbs scattered on the ground, *etc*. Before the nut was cracked it had been *material* for carrying out an action, whereas after the nut had been cracked it was a *product* of this action. Therefore, a *result* always means a state of affairs that has been caused by an agent's effort, whereas a *product* refers to a certain thing whose state is the result. Thus, the distinction between static results (states of affairs) and kinetic results (events) also cannot be reconciled with Kotarbiński's reistic

[9] As Kotarbiński explicitly states, "a result is always an event, and an event is always either a change of something or a state of something" (Kotarbiński 1995, p. 42).

sentiments. The other classifications of results (for example, the division of results into constructive and destructive ones, which literally implies that certain properties are acquired or lost) can also be evaluated in a similar way. With this statement I will finish analysing the most important concepts that are related to the theory of agency and based on Kotarbiński's praxiology, and I will proceed to draw relevant conclusions.

3. Summary

The following conclusions can be drawn from the analysis. This analysis clearly shows that, by using the language of reism, it is impossible to make many distinctions that can be considered crucial to the concept of action and agency as developed by Kotarbiński (for example, the distinction between a free impulse and an agent or between a result and product). When interpreted literally, the concept of agency that was proposed by Kotarbiński is completely inconsistent with reistic ontology (it postulates that events, relations, sets, states of affairs and properties exist) and nonsensical in light of the strong version of semantic reism. Kotarbiński himself did not try to paraphrase non-reistic statements into reistic ones in order to demonstrate their consistency with concretist ontology and semantics, which calls into question the ambitious programme of "dehypostasising" the humanities and philosophy. What is more, even if one is able to propose certain reistic paraphrases of non-reistic statements, these paraphrases:

(i) are often more complicated and less intelligible than statements containing hypostases;
(ii) are not produced in accordance with general structural rules that assign concrete conditions of trueness, formulated entirely in a concrete language, to particular statements containing hypostases (see Wolniewicz 1984).

As a result, it is impossible to decide whether a given paraphrase is adequate (moreover, many different but equally adequate paraphrases may exist).

To sum up, one can argue that perhaps it is Kotarbiński's theory of action that constitutes one of the stronger arguments for rejecting the ontological and semantic version of reism.

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APPLYING THE THEORY OF KAZIMIERZ AJDUKIEWICZ AND JÓZEF M. BOCHEŃSKI TO THE FORMULATION OF AN ONTOLOGICAL THESIS. A SKETCH OF NON-ENDURANTISTIC SEMANTICS

1. A Sketch of Ajdukiewicz's Theory of Categories of Expression

Among all of Ajdukiewicz's definitions of category of expression, the most well-known is that:

(Ajd. Def. category-of-expression) Expression *A* taken in meaning *a* and expression *B* taken in meaning *b* belong to the same category if and only if each sentence Z_A, consisting of expression A used in meaning *a*, after exchanging expression *A* into expression *B* used in meaning *b* (without a changing of meaning and mutual connections of all other expressions) turns into a sentence and *vice versa*: every sentence Z_B, consisting of expression *B* used in meaning *b*, after exchanging expression *B* into expression *A* used in meaning *a* (without a changing of meaning and mutual connections of all other expressions) turns into a sentence.

The basic assumption, accepted by Ajdukiewicz, is the one-operator principle. This rule has two different formulations. The first one runs as follows:

(OOP.1) In each complex meaningful expression, the relations of attachment which hold between the operators and their arguments must have such a form that the whole expression can be divided in such a way that one of the parts of that expression is an operator and the

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> other parts belong to the operator as its arguments. We call such an operator the «principal operator of this expression».[1]

The second formulation is stronger – only one way of division is permitted:

(OOP.2) Each meaningful and univocal expression composed of more than one word, so each sentence also, can only be divided in one manner in such a way that one of the parts refers to the others and connects them into a uniform whole (Ajdukiewicz 1985, p. 345).

As we think, and what we'll show in a further passage, principle (OOP.1) and principle (OOP.2) have a different field of application.

The main doubt concerning the one-operator principle (OOP) is relevant to its application: how does one recognise whether a certain expression is meaningful? And, how does one distinguish the operator from its arguments?

Ajdukiewicz maintained that in each meaningful and complex expression it is indicated somehow as to which expressions are the functors and which are the arguments.[2] What is more, he claimed that if the operator has more than one argument, it must also be marked which argument is first, which is second, which is third and so on.[3] Perhaps he claimed this because he was convinced that an analogy between the expressions of natural and artificial languages exists, *e.g.* the word "likes" in the sentence "John likes Peter" plays a similar role to "+" in "3 + 5."[4]

However – as Ajdukiewicz remarked – there is a fundamental difference between artificial and natural languages: the expressions of an artificial language are univocal, whereas the expressions of a natural language, the expressions of common speech, often have an uncertain meaning, *i.e.* they are ambiguous. In many cases, acknowledgment of the meaningfulness of an expression must be preceded by a precise statement of the meaning of its components and by settling the syntactical categories to which the components belong.

Ajdukiewicz proposes to distinguish "common natural language" from "language" in its exact meaning:

> We use the word "language" in such a meaning that in one and the same language there are no ambiguous names (and no ambiguous expressions belonging to any semantic category). According to this we will not acknowledge as language, the set of

[1] Ajdukiewicz (1935), p. 226.
[2] *Cf.* Ajdukiewicz (1935), p. 226.
[3] *Cf.* Ajdukiewicz (1935), p. 226.
[4] *Cf.* Ajdukiewicz (1927/28), p. 7.

> expressions commonly accepted as the Polish language. We must divide that set of expressions into several sets in such a way that there are no ambiguous names in each subset. These subsets we will call "languages" [...]. When speaking in further passages about the Polish language we shall accept this overall fiction that the language satisfies the condition of a univocal character (Ajdukiewicz 1927/28, p 25).

According to the distinction as presented above we may say that the one-operator principle in the first formulation (OOP.1) applies to complex expressions of common speech, *i.e.* complex expressions of non-idealised language, whereas the one-operator principle in the second formulation (OOP.2) applies to complex expressions of language in exact meaning.

There is no doubt that the one-operator principle is the most important assumption of Ajdukiewicz's theory of grammar, but it is problematical as to what this theory's other assumptions are. Scholars' views vary on the subject.[5]

We propose accepting that the second basic assumption of Ajdukiewicz's theory of grammar is the thesis that we will call the "heirdom-of-meaningfulness principle" (HMP). It runs as follows:

(HMP) Each principal operator and each argument of the principal operator of a certain expression is meaningful.

This rule is expressed by Ajdukiewicz as follows:

> Each k-order component of a meaningful expression (except the component of 0-order) is either a principal operator of the (k-1)-order component or the i^{th} argument of the (k-1)-order principal operator. This component of the (k-1)-order is then, on condition that $k\text{-}1 \neq 0$, either the (k-2)-order principal operator or its j^{th} argument (Ajdukiewicz 1960b, p. 346).

Finally, Ajdukiewicz accepted at least four fundamental categories of expressions (names, declarative sentences, interrogative sentences and imperative sentences) and an infinite quantity of derivative, operational categories. In the years 1930–1931 he elaborated a very clear and useful notation, *i.e.* he proposed providing each expression with a proper index of a category which this expression belongs to. The name is symbolised by "*n*," a declarative sentence (in short: a sentence) by "*s*," an interrogative sentence (in short: an interrogative) by "*s*?" and an imperative sentence (in short: an imperative") by "*s*!." The operator is symbolised by a fraction. Its numerator is constituted by the symbol of the category (categories) of the operator's argument (arguments), whereas its denominator is constituted

[5] *Cf.* Buszkowski (1989), pp. 20–21, Jadacki (2002), pp. 136–139, Tałasiewicz (2006),pp. 53–60.

by the symbol of the category of expression created by that operator together with its argument (arguments). For example:

(1) sentence-building operators which have (a) name (names) as (an) argument (arguments) are symbolised by: "*s*/*n*," "*s*/*nn*," "*s*/*nnn*" and so on;
(2) sentence-building operators which have (a) sentence (sentences) as (an) argument (arguments) are symbolised by: "*s*/*s*," "*s*/*ss*," "*s*/*sss*" and so on;
(3) name-building operators which have (a) name (names) as (an) argument (arguments) are symbolised by: "*n*/*n*," "*n*/*nn*," "*n*/*nnn*" and so on;
(4) name-building operators which have (a) sentence (sentences) as (an) argument (arguments) are symbolised by: "*n*/*s*," "*n*/*ss*," "*n*/*sss*" and so on.

In this paper we use lineal notation instead of Ajdukiewicz's fractions, for example: "*s*/*n*," "*s*/*n*//*s*/*n*" instead of: $\frac{s}{n}$, $\frac{\frac{s}{n}}{\frac{s}{n}}$.

Ajdukiewicz applies the notation as presented above to check whether an expression is syntactically compact. He introduces three concepts: the concept of the well-turned expression, the concept of right through well-turned expression and the concept of a syntactically compact expression. The definitions run as follows:

(Ajd. Def. Well-turned-expression) Expression *W* is well-turned if and only if it satisfies the one-operator principle (OOP).[6]

(Ajd. Def. Right-through-well-turned-expression) Expression *W* is right through well-turned if and only if it satisfies the one-operator principle (OOP) and each its component also satisfies the one-operator principle (OOP).[7]

(Ajd. Def. Syntactically-compact-expression) Expression *W* is syntactically compact if and only if (1) it is right through well-turned and (2) the expression's components of the same level correspond with one another.[8]

This mutual correspondence of components may be explained by using an example: for instance, if the component of a certain expression is an

[6] *Cf.* Ajdukiewicz (1935), p. 226.
[7] *Cf.* Ajdukiewicz (1935), p. 226.
[8] *Cf.* Ajdukiewicz (1935), p. 227.

R-level operator symbolised by "*s*/*ns*," it must correspond with two *R*-level arguments: the first must be a name and the second one a sentence.

Additionally, Ajdukiewicz accepts the *explicit* thesis:

(Th. U) A complex expression is univocal if and only if it is syntactically compact[9]

And the *implicit* thesis:

(Th. Non-sens.) If the expression is not syntactically compact, it is nonsensical.

We will omit a presentation of the varied difficulties connected to Lesniewski-Ajdukiewicz's theory of grammar and now we will shortly present some of its applications.

2. Ajdukiewicz's Applications of This Theory of Expressions' Categories

At the end the lecturer pays attention to the significance of the problems as presented above for ontology (the theory of objects), psychology (sentence components which are not sentences correspond with thoughts which are neither propositions [(Germ. *Urteil*) – A.H.] nor representation [(Germ. *Vorstellung*) – A.H.], or logic (the theory of definition).[10]

Unfortunately, nothing is known about Ajdukiewicz's particular outlook on the importance of the theory of expressions' categories for philosophical sciences. The first time Ajdukiewicz presented an application of this theory was in *Lectures on logical semantics* at Jan Kazimierz University in Lviv during the academic year of 1930/1931. He applied the theory mentioned above to the antinomy of liars, the antinomy of classes, the antinomy of properties and the problem of universals.

Most of Ajdukiewicz's solutions of antinomies have one schema:

I. Formulation of definition (Def_a), which is the foundation of antinomy.
II. Acceptance of the assumption concerning the syntactical categories of the definition's operator.
III. Categorical analyses of definition.
IV. Demonstration of the syntactical incompactness of definition (Def_a).

[9] *Cf.* Ajdukiewicz (1935), p. 227.
[10] Ajdukiewicz (1925), p. 164b.

V. Coming to the conclusion (on the basis of (Th. Non-sens.)) that the definition (Def_a) is nonsensical.
VI. Coming to the statement that the formulation of antinomy it also nonsensical.

3. Bocheński's Enlargement of Leśniewski-Ajdukiewicz's Theory of Expressions' Categories

The questions as to what the operator is and how to recognise the operator in a certain meaningful expression are answered by Innocenty Maria Bocheński in his paper titled "On the Syntactical Categories."[11] In the article Bocheński proposes the ontological background of Leśniewski-Ajdukiewicz's theory of categories of expressions. He claims that:

> There can be only two alternative structures of a sentence: (1) either it is composed of one symbol only or (2) it is composed of more symbols and in that case there must be a connection between the symbols turning them into a meaningful whole (Bocheński 1949, pp. 262–263).

According to Bocheński this connection is "always constituted by a determination of one or more symbols by another symbol."[12] Determination is defined as follows:

(Boch. Def. Determination) The symbol *x* determines the symbol *y* if and only if what is meant by *x* is a property of what is meant by *y* – the word "property" being understood in the widest possible sense, which includes essential factors, necessary and accidental properties and also relations.[13]

Apart from that, Bocheński accepts several theses, two of which are the most important:

(Boch. Th. 1) If and only if *x* determines *y*, we shall say that *x* is an operator of *y*, and *y* the argument of *x*.[14]
(Boch. Th. 2) Whenever a symbol *x* is an operator of another symbol *y*, the category of *x* is not identical with the category of *y*.[15]

[11] Bocheński (1949).
[12] Bocheński (1949), p. 263.
[13] Bocheński (1949).
[14] Bocheński (1949), pp. 263–264.
[15] *Cf.* Bocheński (1949), p. 265.

(Boch. Th. 3) Each expression whose components do not satisfy (Boch. Th. 2) is nonsensical[16].

We will present Bocheński's applications of an enlarged theory of expressions' categories.

4. Bocheński's Applications of the Theory of Expressions' Categories

Bocheński applied the theory as presented above to solve some logical and philosophical problems. What is interesting is that he applied it exactly to the same problems to which Ajdukiewicz applied his own theory. However, the solutions of both authors are independent of one another. Bocheński's applications are as follows:

(a) The problem of the univocity of being

According to Bocheński, the problem of the univocity of being may be formulated as a question: "Is there any property common to all entities?". Bocheński writes that it may seem that being is such a property. He claims that there is a syntactical analogue of that problem and tries to solve it by using the theory of expressions' categories.

He introduces the concept of meaning and the concept of univocity. According to Bocheński, "meaning is a (heterogeneous) tetradic relation: for if we have a meaning, there is always a symbol a, a language l, in which a means something, a thing x, which a denotes and a property f which it connotes"; in short we have: "$S(a, l, x, f)$." The univocity is also treated as a relation. It is a relation which holds between the two words a and b of one language l, two things x and y denoted respectively by a and b and two properties f and g connoted respectively by a and b, in short: "$Un(a, b, l, x, y, f, g)$." Things x and y are different and properties f and g are identical. The univocity is defined as follows:

(Boch. Def. Univocity) $Un(a, b, l, x, y, f, g) \equiv (S(a, l, x, f) \wedge S(b, l, y, g) \wedge Is(a, b) \wedge x \neq y \wedge f = g)$,

where:

"$Is(a, b)$" means: "a and b have the same graphical form";

"$S(a, l, x, f)$" means: "symbol a in language l means thing x and connotes property f";

[16] *Cf.* Bocheński (1949), pp. 272–273.

"$S(b, l, y, g)$" means: "symbol b in language l means thing y and connotes property g."

Bocheński maintains that unvocal symbols must belong to the same syntactical category because of the same graphical form and the same meaning. On the basis of (Boch. Def. Determination) he concludes that if f is an accident of a then "f" must be an operator of "a," and, in consequence, "the symbols of substances must be names and symbols of accidents must be operators."[17]

As we can see, on the basis of the accepted assumptions, the thesis on the univocity of being is false. If symbol "a" which denotes a substance is a name and symbol b which denotes a property of that substance is an operator, then (1) the operator "being" whose argument belongs to the category of names and (2) the operator "being" whose argument belongs to the category of operators must belong to different categories. In other words, in formulae "$B_1(a)$" and "$B_1(b)$," if the category of "a" is not identical with the category of "b" then the category of "B_1" is not identical with the category of "B_2." Hence, these two types of "being," "B_1" and "B_2," are not univocal.

(b) The problem of universals

Bocheński notices that universal symbols do not need to be names – they may be operators.[18] He claims that all operators used in contemporary logic and other sciences are universal symbols. He proposes translating the hypothesis on universal symbols into syntactical language. In consequence, it turns out that "verbal universals are always operators, not names."[19] Bocheński is of the opinion that it is impossible to demonstrate that universals exist or that they do not exist, because it is possible to introduce new syntactical categories and to decide arbitrarily which categories belong to the system and which do not.

5. Other Applications of Ajdukiewicz-Bocheński's Theory or Expressions' Categories

Now let us consider the problem of the possible division of a meaningful expression. In our opinion the following passage taken from one of Ajdukiewicz's papers is very important:

[17] Bocheński (1949), p. 276.
[18] *Cf.* Bocheński (1949), pp. 277–278.
[19] Bocheński (1949), p. 278.

> Philosophers use common speech in their considerations. This speech, as we have noticed, is ambiguous. Philosophers, when stating precisely the language which they use, [...] enter into one of the tracks which speech leaves wide open. The precise statement of language in such or another manner entails making a choice between one of the many possible conceptual apparatuses that are potentially inherent in the system of meanings of common speech expressions (Ajdukiewicz 1934, pp. 277-278).

Ajdukiewicz claims that when two philosophers use two different conceptual apparatuses, A_1 and A_2, the hypothesis formulated by one of them within A_1 cannot be formulated by the other within A_2.

Let us consider two possible partitions of a sentence from non-idealised common speech:

THE RAIN-STORM STOPPED IN THE MORNING. Perhaps Ajdukiewicz would present the analysis as follows:

(A) $\overbrace{\underbrace{\text{The rain-storm}}_{n}\ \underbrace{\underbrace{\text{stopped}}_{s/n}\ \underbrace{\text{in the morning}}_{s/n//s/n}}_{s/n}}^{s}$

However, Wojciech Buszkowski proposes such an analysis:

(B) $\overbrace{\underbrace{\underbrace{\text{The rain-storm}}_{n}\ \underbrace{\text{stopped}}_{s/n}}_{s}\ \underbrace{\text{in the morning}}_{s/s}}^{s}$

In the light of what Ajdukiewicz wrote, we claim that the difference in the partition of the expressions is not a common variance. In the background of these analyses we have two different assumptions about the structures, two different assignments of meanings and two different conceptual apparatuses. The principal operators in (A) and (B) belong to different categories. The structures of the state of affairs referred to by (A) and referred to by (B) are not the same. In Ajdukiewicz's interpretation temporality is the property of the stop of the rain-storm, whereas in the interpretation of Buszkowski temporality is the property of the state of affairs: that the rain-storm stopped. This difference is not significant from the point of view of common everyday communication, but it is significant if we consider philosophical ontological theories.

Contemporary ontologists do not agree about what is referred by the sentence: "Object *A* is endowed with property *P* in moment *t*" (or, in short: "Object *A* has property *P* in moment *t*"). Adherents of various ontological doctrines propose various interpretations of the above sentence according to their own opinions on the nature of the relation between object *A*, property *P* and moment *t*. Mariusz Grygianiec, in his book titled *Identyczność*

i trwanie. Studium ontologiczne [*Identity and Persistence. An Ontological Study*], confronts five different opinions about the interpretation of the above-mentioned sentence. This sentence may be equivalent to one of the following sentences:

(a) "$A_{\text{in moment } t}$ has property P"
(b) "A has$_{\text{in moment } t}$ property P"
(c) "A has property $P_{\text{in moment } t}$"
(d) "$_{\text{in moment } t}$: A has property P"
(e) "A has property P in moment t."[20]

The interpretation (a) is accepted by perdurantists; the name "$A_{\text{in moment } t}$" refers to the temporal part of an individual. Solution (b) is accepted by adverbists, who maintain that the relation between a property and an object is temporal. Adherents of the doctrine, according to which property P is temporal, propose interpretation (c). Interpretation (d) is the interpretation of the factists, who claim that the state of affairs "A has property P" is temporal. And solution (e) is accepted by those ontologists who claim that what we are dealing with here is a three-argument relation – a relation which holds between object A, property P and moment t. Let us notice that the ontologists either agree to the "indexation" of a chosen element of reality or not.

We claim that the problem of interpreting the sentence "Object A has property P in moment t" may be presented from quite a different point of view – namely from the point of view of the syntactical structure of this sentence. Various ontological outlooks on the nature of the relations between object A, property P and moment t may be reconstructed thanks to different assumptions on the syntactical structure of the sentence "Object A has property P in moment t." The fundamental assumptions of such a reconstruction are:

(1) Syntactical categories correspond with ontological categories.
(2) Each meaningful and univocal expression composed of more than one word may be divided without rest in such a way that one of the parts refers to the others and connects them into a uniform whole (the one-operator principle)
(3) Each principal operator and each argument of the principal operator of a certain expression is meaningful (the heirdom-of-meaningfulness principle).

[20] Grygianiec (2007), p. 80.

Each sentence of the type: "Object *A* has property *P* in moment *t*" of a certain structure *S* will correspond with a certain reality's fraction (namely: the state of affairs) of an isomorphic structure.

Let us consider a different structuralisation of the sentence:

(*) "*A* has *P* in *t*,"

where A is an object, *P* is a property and *t* is a moment (of time). We may decide that:

I. The principal operator of (*) is a three-argument operator "has... in." This operator corresponds with the relations between three elements: object *A*, property *P* and moment *t*.

II. The principal operator of (*) is a two-argument operator. In that case we have several variants:
   (1) The principal operator of (*) is "has," and its two arguments are:
      (a) expressions: "*A* in *t*" and "*P*," where
         (i) "*A* in *t*" is indivisible (is an integral whole),
         (ii) "*A* in *t*" is composed of the operator "in," which connects two arguments: "*A*" and "*t*,"
         (iii) "*A* in *t*" is composed of the operator "in *t*" and the only argument "*A*."
      (b) expressions: "*A*" and "*P* in *t*," where:
         (iv) "*P* in *t*" is indivisible (is an integral whole),
         (v) "*P* in *t*" is composed of the operator "in," which connects two arguments: "*P*" and "*t*,"
         (vi) "*P* in *t*" is composed of the operator "in *t*" and the only argument: "*P*."
   (2) The principal operator of (*) is "has in *t*" and its arguments are: "*A*" and "*P*," where
      (a) "has in *t*" is indivisible (is an integral whole),
      (b) "has in *t*" is composed of operator "in" and its two arguments: "has" and "*t*,"
      (c) "has in *t*" is composed of operator "has in" and its only argument: "*t*," "has in *t*" is composed of operator "in *t*" and its only argument "has."

III. The principal operator of (*) is a ONE-ARGUMENT operator. In that case we also have several variants, but we will present one of them:
   (1) The principal operator of (*) is "in *t*" and its only argument: "*A* has *P*," where:

(a) "*A* has *P*" is indivisible ((is an integral whole), or
(b) "*A* has *P*" is composed of operator "has" and its two arguments: "*A*" and "*P*,"
(c) "*A* has *P*" is composed of operator "*A* has" and its only argument "*P*."
(d) "*A* has *P*" is composed of operator "has *P*" and its only argument: "*A*."

Assuming that syntactical categories correspond with ontological categories, we obtain as many ontological doctrines as different structures exist of sentence (*). Some of these doctrines will be unexpected and astounding, some will *seem to be* absurd, or will simply *be* absurd, some will be at variance with common intuition (we omit many of these structuralisations), but among them we will easily find all of the doctrines enumerated by Grygianiec. It seems that the adherents of certain doctrines must prefer one certain analysis over others. We have:

(A) PERDURANTISM

The perdurantists' assumption is that the principal operator of the sentence "Object *A* has property *P* in moment *t*" (shortly: "*A* has *P* in *t*") is "has" and its arguments are "*A* in *t*" and "*P*," where either

(i) "*A* in *t*" is indivisible (is an integral whole), or
(ii) "*A* in *t*" is composed of the operator "in *t*" and the only argument "*A*."

(B) ADVERBISM

The adherents of adverbism assume that the principal operator of the sentence "*A* HAS *P* IN *t*" is "has in *t*." This operator has two arguments: "*A*" and "*P*."

(C) THE DOCTRINE OF THE ADHERENTS OF THE TEMPORAL "INDEXATION" OF PROPERTY

The adherents of the temporal "indexation" of property assume that the principal operator of the sentence "*A* HAS *P* in *t*" is "has." This operator has two arguments: "*A*" and "*P* in *t*," where:

(i) "*P* in *t*" is indivisible (is an integral whole), or
(ii) "*P* in *t*" is composed of the operator "in *t*" and the only argument "*P*."

(D) FACTISM

Factism's assumption is that the principal operator of the sentence "*A* has *P* IN *t*" is "in *t*." This operator has the only argument "*A* has *P*," which may be indivisible or composed of parts.

(F) ENDURANTISM

For the endurantists the principal operator of the sentence "*A* HAS *P* IN *t*" is a three-argument operator: "has ... in," whose arguments are: object *A*, property *P* and moment *t*.

As we can see, assuming that the correspondence between syntactical categories of expressions and ontological categories of entities are symbolised by these expression, we may point out the fundamental differences between contemporary ontological doctrines. We maintain that the adherents of different ontological doctrines use different languages and different conceptual apparatuses. We claim that the choice of conceptual apparatus takes place not only when we decide about the types and quantity of syntactical categories of expressions, but even when we indicate the components of an expression – its principal operator and the arguments of that operator.

Let us notice that if we enlarge our analysis of the sentence "Object *A* has property *P* in moment *t*" as made above we will obtain as a result an enumeration of all(!) possible ontological views in which object *A*, property *P* and moment *t* are accepted.

6. The Sketch of Non-Enduratnistic Semantics

Below we present a proposal of interpretation of some sentences assuming that one of the non-endurantistic ontological theories is valid and that the theory of Ajdukiewicz and Bocheński is also valid: there is a correspondence between the syntactical categories of expressions and the ontological categories of the entities symbolised by those expressions. It seems that the users of common speech assume endurantism *implicitly*. However, it is problematic whether the sentences of such common speech may by translated into sentences of non-endurantistic language. We are sceptical towards such a translation.[21] We would rather say that by stating precisely the language which we use, we "enter one of the tracks which speech leaves wide open."

[21] Eli Hirsh, in his book Hirsh (1982) expresses the conviction that it is possible to translate sentences from endurantistic into exdurantistic languages; see Hirsch (1982), pp. 191–192.

6.1. *Ontological Assumptions*

We accept the non-endurantistic theory, according to which (a) objects exist in such a way that they have in different moments (of time), temporal parts which are temporally extended and (b) most of the object is not wholly presented at each time of its existence. Let us remember that, according to the endurantistic point of view, objects exist in such a way that (i) they are wholly presented in different moments of time and (ii) they have different (often incompatible) properties in different moments.[22] While endurantists believe that a thing is a material object which exists in different periods, non-endurantists believe that a thing is an object-in-time and consists of many temporal parts, namely, temporal sections.

We accept the following thesis:

(1) Individuals exist; we will symbolize them by capital letters with indexes: "A_{tp-tk}," "B_{tp-tk}," *etc*., where "*tp*" refers to the first and "*tk*" to the last moment of an individual's existence.[23] (In short we will write: "*A*," "*B*," *etc*.)

(2) Temporal parts of individuals exist. The temporal part may be:
   (a) a momentary part of the individual (in other words: a momentary section of an individual); we will symbolize momentary parts by "A_t," "A_{t_1}," "A_{t_2}," *etc*. (for example "A_t" means the "section of individual *A* in moment *t*").
   (b) a temporal part consisting of at least two adjacent momentary parts; these parts we will symbolize by "A_{t_1}–A_{t_2}," where A_{t_1} is the first momentary section of a larger temporal part of an individual *A* and "A_{t_2}" is the last momentary section of that temporal part (in short: "$A_{t_1-t_2}$").

(1) Properties exist; we will symbolize them by capital letters: "*P*," "*Q*," "*R*," *etc*.

(2) Relations exist (among others: the relation of adherence (the fundamental relation between a certain property and a certain thing), the relation of identity, the relation of being a part).

The question arises of whether in common speech there are different categories of names: denoting individuals, denoting momentary sections of individuals and denoting larger temporal parts. It seems that in common language we do not have many individuals' names. For example, from a non-endurantistic point of view the name "Aleksandra Horecka" denotes

[22] Grygianiec (2007), p. 96.

[23] Perhaps also momentary (consisting of only one momentary section) individuals exist.

not, me from the moment of my birth to the present moment, but only a part of me – from the moment of my marriage up to now, because my name changed after marriage from "Aleksandra Białecka" to "Aleksandra Horecka." As we can see, the two names, "Aleksandra Białecka" and "Aleksandra Horecka," do not denote the same person; they denote two separate temporal parts of one person. However, it is also possible to indicate the names of individuals in common language. We will call them "perfect proper names." In common language we can easily find the names of the momentary and larger temporal parts of individuals, for example: the name "John now" in "*John* is *now* pale" or "John today" in "*John* is sick *today*." All of these non-endurantistic names would have the schema: "Object *A*-in-time (moment or period)."

6.2. *Assumptions of Language*

We accept that in our non-endurantistic language there are:

(1) names of:
  (a) individuals (perfect proper names),
  (b) momentary parts of individuals (momentary names),
  (c) temporal parts consisting of at least two adjacent momentary parts;
(2) names of properties;
(3) names of relations;
(4) names of moments and periods (of time);
(5) operators.

6.3. *A Non-Endurantistic Interpretation of Chosen Expressions*

Accepting the assumptions enumerated above, we will now try to interpret some sentences from common language, namely sentences of the type: "*X* is *Y*." The word "is" may have one of several meanings.

(a) Sentences of the type "*X* is *Y*," where "is" means "is identical with"

In sentences of the type "*X* is identical with *Y*," the identity of two objects is ascertained. In endurantistic language "*X*" and "*Y*" represent proper names or general singular names (also descriptions).

Let us assume that "*X*" and "*Y*" represent, in our non-endurantistic language, perfect proper names of individuals: A_{tp-tk} and B_{tp-tk}. In that case in a sentence of the type: "*X* is *Y*," the identity of two non-endurantistic individuals will be ascertained. We assume that the relation of identity which holds between momentary sections of an individual is primary. We will accept that individual A_{tp-tk} is identical with individual B_{tp-tk} if and only if

for each moment from interval $\langle t_p, t_k\rangle$ the momentary part of A_{tp} is identical with the momentary part of B_{tp}:

(Def. ident. individ.) $\forall A_{tp-tk}\ \forall B_{tp-tk}$ (A_{tp-tk} is identical with $B_{tp-tk} \equiv (A_{tp}$ is identical with $B_{tp} \wedge A_{tk}$ is identical with $B_{tk} \wedge \forall t\ (t \in \langle t_p, t_k\rangle \Rightarrow A_t$ is identical with $B_t)))$.[24]

Let us notice that in common language we do not have so many sentences about the identity of individuals regarded as in (Def. ident. individ.). As an example of such sentences we can offer the sentence: "Hugo Grotius is Huig de Groot," or "René Descartes is Renatus Cartesius."

Let us interpret such a sentence:

(*) The only author of the article *Składniki zdań* [*Components of a Sentence*] 1925[25] is the only author of the paper *Związki składniowe między członami zdań oznajmujących* [*Syntactical Connections between Constituents of Declarative Sentences*] 1960.[26]

The sentence (*) is – according to the above-formulated outline – neither about the identity of individuals nor about the identity of the temporal parts of individuals. Not from the moment of birth is Ajdukiewicz the author of the papers mentioned above; the articles were written in different periods. Hence the names: "the only author of the article *Składniki zdań* [*Components of a Sentence*] 1925" and "the only author of the paper *Związki składniowe między członami zdań oznajmujących* [*Syntactical Connections between Constituents of Declarative Sentences*] 1960" refer to different temporal parts of Ajdukiewicz. Sentence (*) is not about identity but about – as we will call it – the "*quasi*-identity" of temporal parts. This *quasi*-identity of temporal parts we propose to define as follows: $A_{t_1-t_2}$ is *quasi*-identical with $B_{t_3-t_4}$, if and only if (1) $A_{t_1-t_2}$ is not identical with $B_{t_3-t_4}$ and (2) such an individual C_{tp-tk} exists that both $A_{t_1-t_2}$ and $B_{t_3-t_4}$, are its temporal parts. Symbolically:

(Def. *quasi*-identity-of-temporal-part-of-individual) $\forall A_{t_1-t_2}\ \forall B_{t_3-t_4}$ ($A_{t_1-t_2}$ is *quasi*-identical with $B_{t_3-t_4} \equiv \exists C\ \forall t\ \forall t'\ (t \in \langle t_1, t_2\rangle \wedge A_t$ is identical with $C_t \wedge t' \in \langle t_1, t_2\rangle \wedge B_{t'}$ is identical with $C_{t'} \equiv \neg(A_{t_1-t_2}$ is identical with $B_{t_3-t_4})))$.

[24] This definition may be derived from the definition of identity of individuals' temporal parts: (Def. ident.of-temporal-parts) $\forall A_{t_1-t_2}\ \forall B_{t_3-t_4}$ (A_{t1-t2} is identical with $B_{t_3-t_4} \equiv (A_{t_1}$ is identical with $B_{t_3} \wedge A_{t_2}$ is identical with $B_{t_4} \wedge \forall t\ (t \in \langle t_1-t_2\rangle \Rightarrow (A_t$ is identical with $B_t)))$.

[25] Ajdukiewicz (1925), pp. 164a–164b.

[26] Ajdukiewicz (1960b), pp. 344–355.

Let us notice that from an endurantistic point of view, the names "the only author of the article *Składniki zdań* [*Components of a Sentence*] 1925" and "the only author of the paper *Związki składniowe między członami zdań oznajmujących* [*Syntactical Connections between Constituents of Declarative Sentences*] 1960" refer to one and the same person – Kazimierz Ajdukiewicz – but connote different properties. From a non-endurantistic point of view these names also connote different properties, but they refer not to one person, but to different temporal parts of one and the same person.

As a consequence of the accepted assumptions we obtain that for the example sentence: "This glass which is now clean is identical with the glass that yesterday was dirty all day" is not about identity but about the *quasi*-identity of two temporal parts of one and the same glass.

According to what we have said above, the status of the sentence "Phosphorus is Hesperus" is different from that presented by Gottlob Frege. Tobias Hansson Wahlberg claims that this sentence is false in the opinion of a perdurantist because the expressions "Phosphorus" and "Hesperus" refer to a different temporal part of Venus.[27] We agree with Wahlberg. For as this sentence is a false sentence about identity, it is, however, a true sentence of the *quasi*-identity.

(b) Sentence of the type "*X* is *P*" with the attributive "is"

In sentences of the type "*X* is *P*" with the attributive "is," *e.g.* "Socrates is pale," it is ascertained that property P is adherent to an object X. Some roperties are adherent to momentary sections and derivatively to larger temporal parts. It seems that in the common language we can easily find sentences in which such adherence is ascertained, for example: "This *flower* is *now* yellow," "*John* is *now* tired." We may interpret these sentences as the "Temporal part of individual A_{tp-tk} in moment *t* is *P*" and write: "$P(A_t)$."

The momentary sections of individuals are endowed with different properties. We maintain that the relations of adherence between a property and a momentary section are primary and indefinable. Some properties are adherent to only one momentary section of an individual, some others are adherent to several adjacent momentary sections. In the last case we may say that a property adheres to a larger temporal part. For example, when a flower is purple in moment t_1 (symbolically: $P(F_{t_1})$) and it is also purple in the next moment t_2 (symbolically: $P(F_{t_2})$), we may say that it is purple in period t_1–t_2 (symbolically: $P(F_{t_1-t_2})$). We obtain:

[27] Wahlberg (2009), pp. 101–102.

((Def-adherence) $\forall A_{tp-tk}\, \forall P(P(A_{tp-tk}) \equiv \forall t\, (t \in \langle t_p, t_k\rangle \Rightarrow (P(A_t)))$.

In the common endurantistic language we talk about change as the following: an individual A acquires in moment t_n property P. In non-endurantistic language we would say: the momentary sections of individual A up to moment t_{n-1} are not endowed with property Q, but the momentary section of individual A in moment t_n and further sections are endowed with property P. We may divide all the properties of the individual into four groups:

(1) properties which an individual neither acquires nor loses,
(2) properties which an individual acquires but does not lose,
(3) properties which an individual does not acquire but loses,
(4) properties which an individual acquires and loses.

For example, being a mammal is the property of type (1), being the author of a paper, being a mother – properties of type (2), being a creature composed of only one cell (in the case of mammals) – a property of type (3), being a newborn, being a student, being tired – usually properties of type (4).

In common language we can state not only the properties of type (1), but also the properties of each type. It seems that in the case of non-endurantistic language we should propose a special interpretation for sentences in which we state properties of the types (2)–(4). We introduce weak-adherence and weak-attributive "is" ("$\text{is}_{\text{w-a}}$"). We propose the following definition:

(Def. weak-atrributive-"is") $\forall A_{tp-tk}\, \forall P\, (A_{tp-tk}\ \text{is}_{\text{w-a}}\ P \equiv \exists t_1\, \exists t_2\, (t_1 \in \langle t_p, t_k\rangle \wedge t_2 \in \langle t_p, t_k\rangle \wedge t_1\, t_2 \wedge P(A_{t_1}) \wedge \neg P(A_{t_2})))$

Many sentences from common language with attributive "is" may be interpreted as sentences in non-endurantistic language with weak-attributive "is"; for example, the sentences "Socrates is pale," "Kazimierz Ajdukiewicz is a Polish philosopher."

(c) Sentences of the type "X is P" with inclusive "is"

In common speech we have categorical sentences of the type: "All X are Y" with inclusive "is." We maintain that such a sentence always consists of two sentences with the "is" attributive. For example, the sentence "All cats are mammals" is equivalent with "For each object, if it is a cat, it is a mammal." However, we distinguish several kinds of properties and – as we shall see – the categorical sentences differ from one another.

Let us consider three sentences:

(A) All cats are mammals.
(B) All newborn babies are toothless.
(C) All old men were newborn babies.

The sentences as written above do not concern objects of the same kind. Sentence (A) is about a property of individuals, sentences (B) and (C) – about properties of the temporal parts of individuals. The properties of being a cat and of being a mammal are of type (1), the property of being a newborn baby is usually of type (4). Being an old man is a property of type (2), being toothless – usually of type (3).

Sentence (A) may be interpreted as follows:

(A′a) $\forall A_{tp-tk}\,(K(A_{tp-tk}) \Rightarrow S(A_{tp-tk}))$.

or:

(A′b) $\forall A_{tp-tk}\,\forall t\,(t \in \langle t_p, t_k\rangle \Rightarrow (K(A_t) \Rightarrow S(A_t)))$.

Let us assume that period $\langle t_p, t_1\rangle$ is the period of being a newborn baby for a certain individual. Sentence (B) we will interpret as follows:

(B′) $\forall A_{tp-tk}\,\forall t\,(t \in \langle t_p, t_1\rangle \Rightarrow (N(A_t) \Rightarrow B(A_t)))$.

Sentence (C) states that some individual's momentary sections endowed with property *P* are preceded by another individual's momentary sections endowed with property *Q*. Let us assume that $\langle t_p, t_1\rangle$ is the period of being a newborn baby and that period $\langle t_2, t_k\rangle$ is a period of being old. We obtain as an interpretation of sentence (C):

(C′) $\forall A_{tp-tk}\,\forall t_n\,\forall t_s\,((t_n \in \langle t_p, t_1\rangle \Rightarrow t_s \in \langle t_2, t_k\rangle) \Rightarrow (S(A_{ts}) \Rightarrow N(A_{tn})))$.

As we can see, sentences of the schema: "*X* is *Y*" with the inclusive "is" have, in non-endurantistic language, different interpretations.

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It seems that the acceptance of endurantistic language could be useful for semiotists in several points. Firstly, the problem of some intentional sentences could be resolved. In many cases it could be proved that two expressions do not have the same denotation, so one cannot be replaced by another. For example, in a sentence about a German man who died before 1945: "Hans knew that in 'Lötzen' there is Feste Boyen," the proper name "Lötzen" cannot be replaced by the proper name "Giżycko" because the name of the city "Lötzen" was changed to "Giżycko" in 1945, and "Lötzen" and "Giżycko" refer to different temporal parts of the same town.

Secondly, the theory of denotation as a set of all designata is slightly different in the case of non-endurantistic language. From an endurantistic point of view denotations change; for example, Stanisław Wyspiański belongs, at first, to the denotation of the name "baby," then to the denotation of the name "kid," *etc*., and at last to the denotation of the name "artist."

The denotations of names, *i.e.* "baby," "kid," "artist," *etc*. change incessantly. From a non-endurantistic point of view the denotations increase but do not decrease – the individuals "leave" in the names' denotations only their temporal time.

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PSYCHOLOGY AND SOCIOLOGY

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THE HUMANISTIC TRAITS OF PSYCHOLOGY AT THE LVOV-WARSAW SCHOOL

1. Introduction

When 29-year-old Kazimierz Twardowski (1866–1938) – at an unusually young age for such an achievement – became the Chair of Philosophy at Lvov University on 15 November 1895, one might expect that his research activity would have focused exclusively on philosophy. However, in those times everyone who (like Twardowski) considered themselves a modern philosopher could not forget about psychology – a discipline with a future, which had been winning numerous followers. As Franz Brentano (1874/1999) maintained, the respectful dignity of psychology undoubtedly derived from the fact that it dealt with the human soul. As Twardowski had been under Brentano's direct influence for nine years (1886–1894), it is no surprise that he did not abandon psychology to concentrate on philosophy alone. Both the said influence and his critical approach to the theoretical and methodological proposals typical for physiological psychology, which he encountered during his laboratory work in Leipzig and Munich, led Twardowski to take the path to psychology which was closer to the humanities than life sciences. His approach to psychology referred to the philosophical tradition and descriptive psychology, focusing on searching for methods specific for the new research discipline.

It is understandable that the core interests of Twardowski included philosophy, major issues regarding the object, act and content of a psychological phenomenon and the possible methods of cognition. These issues in fact have also been important for psychology. The fact that he discovered areas of research that were common for both disciplines, but only examined from different perspectives, should therefore be deemed an important

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motive for getting interested in psychology. This was clearly expressed in his original theory of actions and products (Twardowski 1912/1965).

Another manifestation of Twardowski's involvement in psychology was bringing to Lvov a breath of fresh research thought and introducing the local students and researchers to the analytical principles of methodological reliability and accuracy, taken over from Brentano. Such ideas were rather unknown to the Lvov University community that was, at the time, attached to mysticism and messianism and their specifically understood "Polish spirit." Twardowski, who from his childhood had been under an overwhelming influence of the German culture, customs and language, did not believe in the power and pragmatics of that "spirit," which can be clearly seen in his autobiography and journals (Twardowski 1992, 1997). He viewed philosophical romanticism and the Polish national philosophy as "world views" or "private visions of the world," denying them objectivity or a scientific nature. The scientific method requires precise definitions, scrupulous analyses, reliable interpretations, second thought, enlightened intellect, arguments, differentiating research methods and, in consequence, clear texts, elegant in their simplicity and clarity because only organised thinkers are able to express themselves clearly, whereas convoluted and vague thoughts do not deserve to be uttered, or to be paid heed by any readers (Twardowski 1919–1920/1965).

For Lvov's academic circles, especially for the students, an additional incentive to get interested in psychology and an invitation to practice philosophy in accordance with the rule of "The ABCs of Correct Thinking" (Ajdukiewicz 1959), was the legendary image of Twardowski; his attractive appearance and proud posture (Rzepa 1997). He thus won the "hearts and minds" of some of the outstanding students who gathered around him in the unusual atmosphere of a scientific school. He drew attention not only with his youth, attractive looks, modern interests, readiness to meet in cafés and discuss "life-related" issues, but also with his respect-commanding personality, thorough education, vast knowledge, diligence and severe self-discipline. This was combined with reports of the high prestige of his post-doctoral dissertation, since discussions over his *Zür Lehre vom Inhalt und Gegenstand der Vorstellungen. Einepsychologische Untersuchung* (1894) were held in renowned magazines such as the British "Mind," the American "The Monist," the German "Zeitschrift für Psychologie" and "Zeitschrift für Psychologie und Physiologie der Sinnesorgane," the French "Revue Philosophique" *etc.*, and involved such renowned scholars as Edmund Husserl, Theodor Ziehen, Paul Natorp, Alexius von Meinong and others, who expressed their opinions on the proposals to solve the key problems presented there (Twardowski 1965).

There are many facts proving that psychology had a special status in Twardowski's academic, teaching and organizational activities. One of them could be the very title and content of the lecture (*Psychology in relation to physiology and philosophy*), given on the occasion of the inauguration of the 1896/97 academic year at Lvov University (Twardowski 1897/1965). The text of that lecture should be considered one of the first works in psychology to propagate the new discipline of science and organise its Polish terminology. Further proof of Twardowski's actions aimed at promoting psychology were his efforts to set up a psychology laboratory and to establish psychology as a separate university course.

Twardowski was also the promoter of the first doctoral dissertation in psychology to be presented in Lvov, which in 1901 was defended by Władysław Witwicki (1878–1948). He was also the teacher and master of those who established and organised psychology faculties and studies at Polish universities after Poland regained its political independence in 1918 (Rzepa, 2000). These facts, combined with Twardowski's psychological views and methodological proposals, weigh in favour of considering him the founder of the Lvov School of not only philosophy but also psychology (Rzepa 1998, 1999, 2002; Stachowski 2000; Rzepa, Dobroczyński 2009). In the light of the above thesis it makes sense to mention the long-standing dispute regarding the connections of the Lvov-Warsaw School with the analytical philosophy and neopositivism. The dispute does not bear any special relevance to the psychological current developed within the school; however, it must be emphasised that the predominant opinion in this regard is the one disseminated by Jan Woleński and Ryszard Jadczak on the separate identity and specificity of the "Lvov-Warsaw" philosophy, indicating at the same time that all the three currents of the School (philosophical, logical and psychological) are linked by "the scientific ideology," *i.e.*: rationalism in the sense of antirationalism, faith in the power of science and the role of reason, demand for clarity of thoughts expressed as words and intellectualism (Woleński 1985; Jadczak 1995; Rzepa 1998).

Twardowski's school may boast to be the first to introduce some new ideas in the area of psychology – and not only on a national scale. The vivid discussions that were held at that time with regard to the understanding of the object of psychology, the structure of the psyche, the concept and function of the soul, were crystallised in Twardowski's theory of actions and products, justifying the legitimacy of psychological interpretation which is typical to psychoanalysis. The first native concept of personality, the cratism theory that preceded Adler's theory of will to power (Markinówna 1935), was proposed by Witwicki (1900, 1907). The theory made it possible to explain the genesis of social feelings, the psychological effect of first impression and comic situations, and also enabled a typology of people depending

on their vital power and kind of attitude to others. On that basis, Witwicki (1909) was the first in the world to draw up a psychobiography, featuring Socrates, in the notes to the translation of Plato's *Symposium*. That study preceded the psychobiography of Leonardo da Vinci, written by Sigmund Freud (1910/1975). Moreover, Witwicki (1939/1980) laid the foundations for the theory of cognitive dissonance when he was researching the faith of "enlightened" people and discovered the psychological rule of conflict. Another disciple of Twardowski, Stefan Błachowski (1889–1962) was one of the first to propagate applied psychology using psychoanalytic assumptions to explain the "mental epidemics" connected with the so-called miracle in Słupia near Środa (Błachowski, Borowiecki, 1928). Mieczysław Kreutz (1893–1971) was a fascinating figure with his brilliant defence of the scientificity of introspection (Kreutz 1962). Stefan Baley (1885–1952) was the author of the first text books in educational psychology originally connected with social psychology (Baley 1931, 1935/1948, 1938/1958), and Witwicki – the author of the first text book in Poland covering general psychology (Witwicki 1925/1962, 1927/1963). It is the above mentioned disciples of Twardowski that became (after 1918) the Chairs of psychology faculties at Polish universities – apart from the Jagiellonian University where the Chair of psychology was held by Władysław Heinrich (1869–1957).

All this evidence serves to prove that the development of Polish psychology is strictly connected with the activities of Twardowski and his disciples and dated to the Lvov period, *i.e.* 1895–1919. Later on, the main assumptions of psychology practiced "the Lvov way" were disseminated in other academic centres: Warsaw, Poznań, and Vilna. Psychologists of Twardowski's School – just like their Master – preferred Brentano's descriptive psychology, which was considered one of the fundamental sources of humanistic psychology, instead of the experimental psychology that was dominating at that time. Due to that, the psychology taught by them was characterised by a humanistic touch. This thesis may be substantiated in relation to understanding the object of psychology and its methods and – to a lesser degree – to the theories explaining mental processes and human behaviours.

2. The Object of Psychology

Humanistic psychology is deemed to be one of the three distinctive psychological currents (along with psychoanalysis and behaviourism) of a phenomenological nature. This branch of psychology is interested in a holistically and functionally perceived human being, with unique properties and individualised experience. Humanistic psychologists, represented mainly by Carl

Rogers (1902–1987) and Abraham Maslow (1908–1970), are interested in gaining knowledge on a healthy, normal individual, being a sentient entity rather than an object of someone's influence, capable of making his/her own decisions/choices, to overcome the past and "to project oneself" into the future, and thus to take responsibility for his/her own life and own creative development and for finding his/her own place in the world (Bugental 1978; Jourard,1978; Rogers 1978; Maslow 1983, 2006).

In his treatise published in 1897, Twardowski proved not only that psychology was a separate branch of science, but also indicated the necessity to change the way of presenting its object as spiritual – or still better – mental life. He emphasised the views of Juan Luis Vives (1492–1540) who recommended that metaphysical speculations and questions on the nature of the soul be abandoned in favour of examining its properties and functions. Since then Twardowski consistently refrained from making statements on the ontology of the soul and its relation to the body (Ingarden 1963; Twardowski 1965; Jadczak 1995; Rzepa 1997; Rzepa and Dobroczyński 2009). This "dodging" approach to the nature of the soul and its connections with the body was typical of the psychologists deriving from Lvov. They maintained that internal life in terms of functionality is composed of mental facts and dispositions. Internal life is always subjective: experienced by somebody, directly and obviously given in an internal experience thanks to the introspection available to every human being – "the royal path" to the *psyche*. The obvious precondition of mental life is biological existence, *i.e.* the physical life composed of physiological processes and dispositions. In fact it is not worthwhile dealing with the nature of mental life since psychology is more concerned with its functioning and because direct experience (introspection) makes it possible to have an insight into its properties and modes of action. In this discussion, the voice of Witwicki (1925/1962) stood out, who unambiguously stated that there was only one thing to do to find out whether the soul exists: to die. It is also not worthwhile pondering over the kind of relations between the body and soul as earthly existence renders it impossible to investigate the nature of the soul and, moreover, the nature and functions of the body are the object of physiology – not psychology.

Mental life consists of many mental actions (acts) resulting in mental products (representations, judgements, concepts). Since mental actions and products are interdependent, they may be called mental facts (phenomena). They consist of specified contents and acts, intentionally referring to the objects from the external world. The common feature of mental facts is their remarkably subjective nature and individualised, unique, and consistent way of experiencing (the acts), though their contents vary. For a mental fact to come into being in a human *psyche*, it is not enough for it to be "any fact." For it to appear, a specific power is required – a power to make experiencing

this fact sufficiently distinct. This precondition, formulated by Witwicki (1925/1963), was a novelty among the psychological views prevailing in the 20s of the 20th century. This is because in the proposed perspective, awareness is not equal to mentality. "Mentality" refers to the totality of mental facts and dispositions, regardless of their intensity, whereas "awareness" refers only to those of them which are characterised by a specified intensity. The consequence of this approach was assigning *raison d'etre* to subconscious and unconscious phenomena which were ascribed a driving role consisting of channelling the mental life (Rzepa 1991).

The object of psychology also includes dispositions, *i.e.* the conditions of mental facts, *e.g.* sensitivity, memory, intelligence, character and will. Dispositions may be either innate or acquired. However, they should not be equated with mental facts, since they are not given – either directly or in an obvious way – in internal experience.

Accentuating the phenomenological bases of cognition and its subjective, unique nature, emphasising the functional properties of *psyche* and acknowledging the differences between the awareness and mentality, and also the unique (though unfortunately not holistic) attitude to the "soul-body" relation, brings a humanistic trait to the views on the object of psychology, propagated by the psychologist of Twardowski's School.

3. The Method of Psychology

Humanistic psychology allows for the application of any research methods worked out within the framework of psychology, with reservations respecting empathic dialogue (and not manipulation) in the situation of communication between the psychologist and the examined person, and accounting for the unique, subjective perspective of the world view, specific to each human being and revealed especially in the psychotherapeutic process.

The psychology practiced in the Lvov-Warsaw School was characterised by some methodological differentiators that enhanced the thesis on its humanistic features. The first of them was the indisputable "attachment" to introspection as the basic method of psychology, saturated with subjectivity. Introspection is the only source of direct cognition of the psyche, though not free from insufficiencies. The drawbacks of introspection include: (1) a limit to the mental life of the same single person only, which means overwhelming subjectivity; (2) the inability to experience mental facts concurrently with their reliable and systematic observation. As for the latter drawback, Twardowski (1913/1965) proposed mitigating it by way of applying an experimental method, thus copying the solution implemented by German psychophysiologists since the times of Gustav Theodor Fechner (1801–1887) and

consisting in the registration of somatic symptoms accompanying mental phenomena. A solution proposed by Twardowski (1912/1965) with regard to the former drawback is in turn his original idea, which has been underappreciated by psychologists to this day. It is the theory of actions and products, which provides a clear framework for the so-called object method making it possible to overcome the overwhelming subjectivity of introspection via the interpretation of the facts of somebody else's mental life. This is because they may be reconstructed after reaching relevant psychophysical products, *i.e.* retained mental products (thoughts, feelings, representations, desires, fantasies and the like), arising in the minds of their creators. Fleeting mental products gain the durable form of psychophysical products as soon as they have been transformed into psychological documents. These should include (*inter alia*) diaries, autobiographies, correspondence, results of psychological tests, literary works, artworks, musical compositions *etc*. in which the mental products are retained regardless of the passage of time, as if – using Twardowski's terminology – they were "enchanted" in there. The psychological interpretation of somebody else's mental products is an extremely difficult task, since it requires appropriate knowledge resources and skilful use of psychological intuition and analogy. Despite these difficulties, psychologists should constantly deepen their interpretation competence, since it is they who make it possible to significantly widen the knowledge of other people's mental lives and to mitigate the accusation of the overwhelming subjectivity of introspection. These proposals postulated by Twardowski were successfully applied by Witwicki (1927/1965, 1938, 1939/1980), especially in the process of interpreting observed and/or described human behaviours (the life observation method). They were also propagated by the defender of the introspection method – Kreutz (1962).

Another methodological differentiator of Lvov School psychology is the analytical method in the descriptive variant, applied mainly to define psychological concepts according to the idea that any phenomenon should first be clearly, explicitly and reliably described before it can be explained.

> Thoughtful, accurate analysis of even one fact is enough to obtain general theorems, and then we are only left with checking what we have discovered, based on the same or even only very similar experience. This is the descriptive analytical psychological method that was developed by Twardowski himself, and established in psychology via his […] disciples (Słoniewska 1959, p. 21).

The next methodological differentiator of Lvov School psychology is the specific attitude to the relations between psychology and physiology. Although Twardowski and his disciples encountered psychophysiology and psychophysics during their work in German laboratories, despite deeming their experiment to be (also) a psychological method useful especially for the purposes of authenticating the results of introspection and even

though they constructed and used an apparatus (popular at that time) for measuring physiological processes accompanying cognitive processes, they rejected practicing psychology in the form endorsed by Wilhelm Wundt (1838–1920). The Lvov laboratory functioned on different principles that accentuated the necessity of psychological description and interpretation. After all, Twardowski "did not suspend, not even for a moment, description and analysis of data on internal experience to statistics of physiological reactions" (Witwicki 1921, p. XIV). Another one of the principles specified a departure from the pattern that was then very popular and also unquestioningly introduced to psychology on a massive scale, consisting in the unlimited production and application of tests for virtually "every occasion." Due to taking a determined attitude, mainly on the part of Witwicki (1928, 1929), Polish psychologists took a conservative approach towards tests, thus protecting themselves from test mania.

The issue of communication between a psychologist and examined people within the school was resolved in a little "less humanistic" manner. It should be made clear from the start that neither Twardowski nor his disciples practiced psychotherapy. Witwicki, Błachowski and Baley were only involved in counselling psychotechnicians and psychologists practicing at schools, work places and in judicature. Twardowski and Kreutz never dealt with these areas of psychological activity, even though Twardowski was the first in Poland to create a model of communication between a psychologist and an examined person (Twardowski 1912/1965; Rzepa 1992). The model involves: 1) the psychologist interpreting the mental products and reconstructing (by means of introspection and analogy) a given person's mental life; 2) the mental product (sign, symptom) or permanent, interpretable psychophysical product (psychological document); 3) the creator of products. The two most important elements of this model remain the products and the psychologist who interprets them. The creator of the products does not have to be physically present in the communication process. The proposed model is therefore of a one-sided nature, inconsistent with the idea of humanistic psychology which assumes a dialogue-based and dynamic communication between the examined person and the psychologist capable of adopting the world-view perspective of the examined person. It is true that a psychologist could not perform this act without interpretive skills, intuition and knowledge, the importance of which was emphasised by Twardowski and his disciples. Nevertheless, none of them used these skills to establish and maintain psychotherapeutic relations based on direct, emphatic contact between the psychologist and the patient. Most probably it was because both Twardowski and his disciples took a negative attitude towards Freud's psychoanalysis and its "non-scientific" method, requiring readiness to enter vague therapeutic relations with another human.

The discussed communication model, typical for psychologists deriving from Twardowski's School, required that a researcher should take the attitude of a neutral, non-interfering, objective observer, assuming the role of the inspector of a psychological examination process. The basic task of a psychologist following this model was to acquire appropriate products from the examined persons and to interpret them. Therefore, this "psychologist-examined person" communication model can hardly be assigned humanistic features.

The following traits characterise the methodological specificity of Lvov School psychology: accentuating the role of introspection as a direct method of the cognition of mental life, application of the analytical method to describe and interpret mental products, emphasising the role of knowledge and intuition in psychological cognition and rejecting the psychophysiological paradigm of research. It is worth noticing that the proposals taken together changed the methodological perspective commonly found in the psychology of that time. According to them, it was not the life sciences and the method of observation and experiment, but the humanities with the method of interpretation and analytical deduction that should unravel the secrets of human *psyche*.

4. Psychological Theories

Apart from the assumptions regarding the object of psychology and its methods, two theses are accentuated in the humanistic current (Maslow, 2009): (1) the major mechanism of human actions is based on the possibility of making choices; (2) each human is capable of creative self-actualisation. The question is whether these assumptions may be found in the psychological theories that arose within the framework of Twardowski's school.

When it comes to the major mechanism of human actions, in this regard the psychologists of Lvov did not prove especially creative, as they either did not address the topic (Twardowski, Kreutz), or they copied the proposals of other European psychologists (Baley, Błachowski). Only the proposal made by Witwicki (1900) deserves to be called humanistic – even though only to some extent – as he considered ambition to be the major mechanism of human actions. Due to ambition which is treated as an instinct, a human being gains the feeling of being powerful, *i.e.* independence, equality or superiority to other people, to oneself and to the environment, is able to overcome the past and anticipate the future, even though he or she rather remains its reactive subject. It is the accentuation of not so much instinctive, but future aspects of human actions that is compliant with the humanistic

approach, where a person focused on remote goals takes responsibility for his or her life and development.

Nevertheless, we must admit that in relation to the assumption on human creativity the proposals of Witwicki (1927/1963), falling within the scope of arts psychology, show a truly humanistic nature. This is because he treated various areas of life as intended for creative activity, accessible to each human in terms of self-actualisation, especially if the product resulting from this form of action was both beautiful and expressive – things he associated with the world of arts. Thus he blurred the border between the world of works created by professionals and by ordinary people. Even common people are able to express their thoughts, aspirations, motives, fantasies and representations via a beautiful and expressive letter, a photograph, a painting, a sculpture, a drawing or a piece of music.

5. Conclusions

Kazimierz Twardowski and his disciples left an indelible mark on Polish psychology, first and foremost due to the fact that the factual basis of the psychological section of the school was the firmly established scientific views, referring to Brentano's descriptive psychology and constituting an acknowledged source of humanistic psychology. The above analysis makes it possible to adopt the main thesis of this article on the humanistic traits of the psychology practiced in the Lvov-Warsaw School. The bases of that psychology can be found in the scientific proposals of Twardowski and his disciples - psychologists, focused around their master in Lvov in the years 1895–1919. The humanistic ideas adopted and disseminated by them concern comprehension of the object of psychology, emphasising its subjective and unique nature, diversity of permissible methods of psychological examination along with interpreting products and life observation which, thanks to the psychologist's knowledge and intuition, enables reconstruction of somebody else's mental facts. Lvov psychology stood out due to its humanistic traits, effective opposition to test-mania and specificity of scientific writing style, distinguished by the impeccable language and numerous vividly and phenomenologically related real-life examples.

Kazimierz Twardowski as the founder of the Lvov-Warsaw School, together with the psychologists coming from that school, should therefore be considered the first creators of the humanistic paradigm in Polish psychology.

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Wioletta Miśkiewicz

EMPIRICAL PSYCHOLOGY IN LVOV. BETWEEN CLANDESTINE LABORATORY AND PSYCHOLOGY WITHOUT TOOLS[1]

1. Introduction

In 1946, while proofreading a manuscript on Polish logicians for Bocheński, Łukasiewicz suggested the deletion of the sentence where Bocheński said that Twardowski "fought psychologism."[2]

Łukasiewicz is not the only one to believe Twardowski never truly abandoned psychologism. The truth is that a kind of "embarrassed" and "prudish" silence accompanies the successive generations of disciples, something like an original sin, unatoned and unforgiven, tarnishing the great master of Lvov: the suspicion of psychologism.

The cataclysm of the Second World War, the lengthy disgrace into which Leopoldian philosophy fell, and the sparsity of Twardowski's own publications, are all certainly responsible for the general ignorance of his original philosophical theories which is the case at the dawn of the 21st century. Twardowski himself says in his *Selbstdarstellung*, that it is principally in his classes that he spread his ideas. However, it is only since very recently that these classes have been widely accessible thanks to the e-LV Digital Archives (http://www.elv-akt.net/).

I am certain that a revival of Twardowskian studies is on the way. For one thing, the theory of actions and products (1911 – APT) is already

[1] The article is a result of the project "The Significance of the Lvov-Warsaw School in European Culture," supported by the Foundation for Polisch Science.

[2] Łukasiewicz (1998), p. 517.

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piquing the interest of the most zealous linguists[3] and even internationally recognized philosophers such as John Searle.[4] For another thing, Twardowski's yheoretical psychology[5] is gaining great visibility from the success of the cognitive sciences and an important historical work done by A. Brożek.[6] Finally, the digital revolution in the sciences leans on ontological questions related to the objectities of science, the digital representation of its sources, and there again, Twardowski's APT theory is surprisingly rich in resources.

In the scholarly world still marked by the rejection of psychologism in logic, some by Frege, some by Husserl, the misunderstanding of the idea of Twardowski's "theoretical psychology" nevertheless remains, for the moment, at the center of the ambiguous reception, if not to say flat out ignorance, surrounding Twardowski's original philosophical ideas.

We shall not here lay out the doctrinal context of the Leopoldians abandonment of psychologism. We have already dedicated several publications to this subject. Rather, we shall here make use of the historical reconstruction of the Leopoldian laboratory of experimental psychology in order to bring to light some essential aspects of the Twardowskian conception of psychology as philosophical science.

2. The History of the Psychology Lab at Lvov

In an important article subtitled "On Psychology, Its Object, Its Tasks, Its Method, Its Relationship with the Other Sciences, and Its Evolution" (1913b), which appeared in *Pedagogical Encyclopedia*, Twardowski[7] affirms that he taught *experimental psychology* in Lvov from the winter semester of 1898/1899 onwards (a class called, "On optical illusions, with illustrations"[8]) and that he had founded the first psychology laboratory in Poland at the Jan Kazimierz University of Lvov, in 1901. This date is

[3] *Cf.* Recent work by Friederike Moltmann.

[4] *Cf.* France-Berkeley Fund 2014: *The Action-Product Distinction and Its Importance for Speech Act Theory and Social Ontology* (Friederike Moltmann/John Searle).

[5] We use the term "theoretical psychology" as an analogue of "theoretical physics" in the sense of Paul Duhem in *La théorie physique*, *son objet et sa structure*. The expression "Theoretical psycholohy," "theoretische Psychologie" was used for the first tile by J. Lindworsky in 1926: *Theoretische Psychologie im Umriss*. Lindworski was a student of O. Kölpe and was close to the school of Würzburg.

[6] Brożek (2011).

[7] Twardowski (1913a).

[8] Twardowski (1898).

accepted by some historians[9] and put into question by others, who give the year as either 1905 or 1907.[10]

Thanks to a document which we were able to find in Lvov as part of our work with the e-LV Digital Archives – an administrative letter from the department of Philosophy at Johannes Casimir University – we can now shine some important clarifying light on the subject.

The letter, from the Department of Philosophy at Lvov's Jan Kazimierz University, is addressed to the Polish Minister for Education and is dated the 7th July, 1920. It concerns the Department of Philosophy's decision on the formal recognition of Twardowski's position as director of the Psychology Laboratory of Jan Kazimierz University. The letter is signed by the dean: Stanislaw Zakrzewski.[11]

The letter's authenticity is confirmed by a note in the Twardowski *Journal* which, for the date 07.07.1920, following a note about the departure for the war of Ajdukiewicz, mentions the meeting and the Department's decision.[12] The carbon copy of this letter can be found in Lvov's Central Archive.

Thanks to this letter, we can reconstruct the unknown details behind the creation of Twardowski's laboratory. Hence, we can affirm with certainty that the Psychological Laboratory (*Pracownia Psychologiczna*) existed at Jan Kazimierz University as an instrument based teaching and research unit from the year 1905 onwards. That year, at the same moment Twardowski's Philosophical Seminar moved into new premises, two rooms were officially granted to the Psychological Laboratory. The alterations and equipment were principally financed by a once off subsidy from the Austrian Ministry (1400 Crowns) but also in part from its own funds (amongst other things, the students' fees). It is true that Twardowski had not yet succeeded in obtaining the creation of a permanent unit of research, autonomous to the Philosophical Seminar and with an ongoing and independent budget. In fact though, Twardowski's Philosophical Seminar actually profited from this situation: Twardowski obtained an accredited assistant's position, which the Austrian Ministry saw as justified precisely because of the psychological work and experiments being carried out there. Let us point out in passing that psychological experimentation already enjoyed a certain prestige amongst the senior State officials who decided financial matters.

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[9] Pieter (1972), p. 396.

[10] Rzepa (1974), p. 37, based on Kleiner (1974), p. 449.

[11] This document was found by Joanna Szaflik during her research in Lvov under the aegis of a mission funded by the Digital Archives of the Lvov-Warsaw School. http://www.elv-akt.net/ressources/archives.php?id_archive=2180.

[12] Twardowski (1997), p. 162.

Up to that point, Twardowski was alone, on top of his own classes and philosophical work, in leading all teaching and tutorials in psychology. From 1907/1908 onwards, the tutorials in experimental psychology (2 hours weekly) were systematically listed in the university's schedule.[13]

The letter found in Lvov also proves that it was only in 1920, after the rebirth of the Polish state, that a Psychology Institute, connected to a chair in psychology, was finally allocated an annual allowance and a permanent post of "demonstrator."

The primary subject of the letter from June 1920 regards two candidates, selected to occupy the positions of professor of psychology and director of the Psychology Laboratory, who are not ready to come to Lvov. Let us recall that at this time the Polish-Soviet war was in full march and the city of Lvov was highly prominent in the landscape of the fighting. So it was by decision of the Philosophy Department that Kazimierz Twardowski, who had already *de facto* occupied this function since 1905, became on/off professor (with two salaries) encompassing both chairs: philosophy and psychology. In the letter, we also discovered that in the academic year 1919/1920, there were 30 students registered for "tutorials" in psychology (*ćwiczenia*) and 12 in "research experimentations" (*prace*). On the basis of that decision, Twardowski would officially take on the function of Director of the Psychology Institute of Lvov from 1920 to 1928. After him, Mieczyslaw Kreutz (1893–1971) would take on the function.

A question presents itself: regarding the date 1901, which Twardowski gives, in his encyclopedia entry of 1913, as the date of creation of a psychology laboratory in Lvov, what does it actually correspond to?

As an aside, remark that the date 1879, given as the date of creation of the "first laboratory of experimental psychology," that is, Wundt's, constituting its official date and title and repeated in many studies like a mantra, with neither criticism nor reference to real historical research, is also erroneous.

It was only 9 years later, in 1896, after the construction of the University's new buildings and thanks to its two auditoriums as well as its state of the art equipment and permanent position for a "mechanic" to tend to the measuring devices, that the Leipzig Institute of Experimental Psychology really became the legendary and world renowned institution of modern psychology.

But let us come back to Twardowski. Firstly, it is justifiable to think that in choosing the date as 1901, Twardowski was aiming to account for his pioneering work in experimental psychology.

[13] *Cf.* Jadczak (1996), p. 111.

Because, often, it is Włodzimierz Heinrich who is considered as the founder of the first Polish laboratory of experimental psychology in 1903 (at the Jagiellonian University). Włodzimierz Heinrich (1869- 1957) who began by studying mathematics and natural science in Zurich, Munich, Paris and Vienna, then moved to philosophy and, finally, completed his doctorate with Avenarius: "Bemerkungen zur neueren physilogischen Psychologie in Deutschland mit besonderer Brücksichtigung der Aufmerksamkeit (1894)"; from 1897 onwards he was an assistant in the Physics Department of the Jagiellonian University.

However, we have evidence to show that Twardowski was conducting psychological work and experiments in his Philosophy Seminar well before 1903.

The *Seminarium Filozoficzne*, was created in 1897/1898 for advanced students, with the explicit aim of training them in philosophical *and* psychological work. The students, once admitted to the Seminarium, had a permanent work station (from 7 in the morning to 10 in the evening), direct access to the Seminar's library, and, above all, to Twardowski himself, who spent most of his time in the Seminar.[14]

Looking to the archives and schedule of the University, we have access to the problematics of the psychology classes and seminars lead by Twardowski: *Psychology* and *Psychology of emotions* (1896/97), *Fundamental concepts of psychophysics* (1897/98), *On optical illusions* (1898/99), *Psychology* and *On the errors of cognition* (1900), *Psychology of taste and smell* (1901/02).[15]

This is why we must ask then, why does he not use the date of creation of the Philosophy Seminar (where he conducted the experiments) as the starting date for psychological experimentation in Lvov?[16]

The truth is rather more surprising. In reality, as evidenced by the correspondence with Meinong – as far back as the academic year of 1896/97, Twardowski was not only conducting exercises in experimental psychology but, furthermore, he was doing it in a physics laboratory. This means they correspond perfectly in time with the Wundtian paradigm of experimental psychology. In the majority of cases, psychology experimentation began in physics departments. (Wundt's personal case, a trained doctor and physiologist, whose basis was therefore in medical and physiological experimentation, was in fact very rare.)

[14] *Cf.* Brozek (2011), pp. 222–227.

[15] http://www.elv-akt.net/ressources/archives.php?id_catalogue=1andordre=title&option=asc

[16] As Fisette/Frechette do in giving the date of the creation of Lvov's Philosophy Seminar as the date of the laboratory's creation (2007, p. 73).

So then, why does Twardowski not give the date of 1896 as the beginning of the laboratory work at Lvov? The creation of Wundt's first psycholab was, as is shown by historical studies, even more modest in scope.

In 1876, the University gave Wundt the use of a small room ("*kleines früheres Auditorium*," which was in fact a narrow classroom from the old boarding school), so that he could store his apparatus which would otherwise have been left lying on a long table in the room where he held his classes.[17] With the modest sum of 231.75 Marks, the University equipped the small room with two sinks, three tables and six chairs.[18] In 1881, the "psychophysical exercises for advanced students" were even listed in the university's schedule, although, given the lack of space, they were conducted in but a very limited manner.

But, as early as 1896/97, Twardowski was conducting experiments in a real physics laboratory where a room was actually reserved for experimental psychology. The problem is that this experimental work took place on the premises of the Experimental Physics Department, in quasi-secrecy and thanks only to the discrete kindness of a physicist colleague. In 1897/8 Twardowski gave an introductory course in psychophysics. The hypothesis that this course was accompanied by the presentation of apparatus and practical work is practically a certitude.

But the problem, and Twardowski speaks of it himself in a letter to Meinong dated the 25 July 1897, is that the upper administration (*hohere Behörden*, notably, the Austrian Ministry) was in the dark about these "arrangements between colleagues":

> Mein College von der Experimental-Physik mir dadurch einen grossen Dienst erweist, dess er mir in dem im Oktober zu eröffnenden neuen physicalischen Institutsgebäude einen Raum zur Verfügung stellt, der als Keimanlage des hiesigen psychologischen Laboratoriums dienen soll. Das geschieht natürlich ganz im Stillen, ohne Wissen der hoher Behörden; ich will auch ganz im Stillen die notwendigsten Apparate sammeln und dann nach einigen Semestern [...] mit Experimental-Collegium hervortreten.[19]

Twardowski – a great legitimist and formalist – would have found it difficult to advertise such insubordination in an encyclopedic publication.

(As a point of interest, the "experimental physics colleague" of whom Twardowski speaks in his letter to Meinong and who allows him access to the experimental physics laboratory is Ignacy Zakrzewski, the same who, many years later, in his function as dean, would sign our letter of July 1920.)

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[17] In Zurich, where Wundt was just before Leipzig, he already had a premises for his apparatus.

[18] *Cf.* Robinson (1987), chap III, p. 3.

[19] Ryszard Jadczak (1951–1998) was the first to draw attention to the fact of this "clandestine laboratory" existing (Jadczak 1996, p. 110).

The main reason why Twardowski gave the year 1901 as the founding date of his laboratory is doctrinal. Over time, Twardowski's influence increased; he became University rector and could easily continue to develop the space he had in the Physics Institute in PsyLab. As we shall see, he nevertheless considers that psychology which, in order to be practiced, requires an education in mathematics and physics, not to be the philosophical science psychology which is dear to him. Twardowski wanted to develop theoretical psychology that would in fact be – if we state it in today's terms – a meta-theory of cognitivist psychology, the metaphysics of cognitivism.

If he was concerned only with the recognition of having preceded W. Heinrich and the Jagiellonian University in his research, we would come back to the question of why he did not give the founding date of his Philosophical Seminar, 1897/98, as the year when his psychological experimentation began? Twardowski's "Seminar" had its own premises: a library, a reading room, a meeting room. It is true that, in 1901, to accompany his class on "Psychology of taste and smell," Twardowski announced the use of illustrated "plates" and, therefore, exercises in sensory observation, which could be considered as a didactic innovation. But he was probably already doing this before 1901 and at the date he gives in the *Encyclopedia*, no more than in 1897, he still had no extra space for experimentation: his only premises remained those of the Philosophy Seminar. He keeps silent, probably for the reasons already given, about the existence of a room for psychology at the Physics Institute.

We find a beginning of the answer in the fact that the year 1901 is the year of the first defense of a doctoral degree in psychology under Twardowski. On the 14th April 1901, Władysław Witwicki, defended his *rigorosum* and a dissertation dedicated to the psychological analysis of ambition. So perhaps Twardowski gives the year 1901 because this first defense, as well as its subject, enables him to announce the birth of the Leopoldian psychology with its specificity already in place: *an empirical psychology based on introspection*. In this way, Twardowski brings to light what differentiates it from Wundt's psychology, Wundt being a sworn enemy of introspection. It is clear that Twardowski's experimentation is also a target of his criticisms.

Wundt remains a defender and symbol of a "hard" line in psychological experimentation, refusing to expand experimentation into "*Ausfrageexperimente*" – that is, experimentation based on introspection and the analysis of statements (K. Marbe, K. Bühler, O. Külpe and the Würzburg School).[20]

[20] Wundt (1907).

Our hypothesis matches perfectly with Twardowski's principle of keeping psychophysics and psychology separate.

At the time of the disciplinary establishment of psychology, and in response to Wundt's dramatic call (*Die Psychologie im Kampf um Dasein*, 1913) to *not* separate psychology and philosophy, Kazimierz Twardowski suggests (in the same year of 1913):

> Would it not, however, be perhaps necessary to separate from philosophy those domains which, under the name of experimental psychology, have developed a technique all of their own and which requires special training in mathematics and natural sciences? This is what has happened in America, covered now by a thick network of psychology laboratories and with many academic chairs exclusively for psychology (Twardowski 1913, p. 326).

By reflecting on what was happening in the US (the founders of the American laboratories had almost all passed through the Leipzig Institute), Twardowski had clearly seen the direction relationships between philosophy and experimental psychology *sensu stricto* were taking. Moreover, he also importantly remarks the almost total disappearance of "psychophysiology" compared with "psychophysics."[21] Confronted with the spectacular discoveries resulting from the alliance of the exact sciences and technology, the psychology which relied on measuring devices from physics became, for many, the symbol of modernity, progress and scientificity. Expectations were immense, and in some cases contradictory. Some thought the new psychology would resolve, once and for all, the problems posed since ancient times by philosophers, others that psychology should instead be determined as a new *sui generis* scientific discipline. But, if so, would it be a natural science or a human science of a new kind? Some hoped that empirical psychology would succeed in ridding the youth of socialist ideas while, for others, it might just carry social progress forward.[22]

[21] In this way, with the contemporary triumph of neurophysiology within the cognitive sciences, we are seeing a final *Aufhebung* of this process, because neurophysiology finally has its technological means: the brass measuring devices have been replaced by MRI and other inventions of advanced digital technology.

[22] Thus, for the Poles (stateless as they were at the time), scientific psychology provided the possibility of conducting research and higher education in their country. For example, in Warsaw, the occupying Russians considered psychology as less likely to stir patriotic ideas than philosophy. Philosophical conventions were unthinkable in this environment, whereas conventions for doctors, naturalists or neurologists were allowed. Thus, a first scholarly society was founded in 1907, The Psychological Society. The progressive intellectuals, often socialist, spread the new science, people like J.E.Abramowski (1868–1918) or J.W. Dawid (1859–1914). However, the public edition of the Warsaw psychologists' Annals of Experimental Psychology was banned under Russian censorship (*cf.* the letter from J.E. Abramowski to K. Twardowski dated the 5th November 1914, *cf.* e-LV Archives).

Parapsychologies and diverse occult sciences proliferated in the confusion and some of these even see themselves as the expression of a new positivist mindset. Hypnotists were rampant.[23] Technology was spinning heads, the effective theoretical complexity was dense and the publications numerous. However, studying the institutional evolution (university positions dedicated specifically to psychology, university teaching programs, the first doctorates and professorship papers, the organization of conventions and the funding of experimental research) clearly shows how psychology was advancing as a scientific and university discipline by progressively assuming its autonomy with respect to philosophy. Examination of the principal facts of this evolution also show how, in advancing, it was already magnifying its own history, as we have shown with the example of the creation of the 'first laboratory' for experimental psychology. Kazimierz Twardowski was a clear and precise actor within this evolution.

My hypothesis, on the question of the principally doctrinal reasons why Twardowski gave the date 1901, is also verified by the fact that, in the same encyclopedic entry from 1913 ("On Psychology, Its Object, Its Tasks, Its Method, Its Relation to Other Sciences and Its Evolution"), it is not the 'Introduction to psychophysics' class of 1897/1898 that Twardowski considers as his first class of experimental psychology, but rather the class of 1898/1899, on optical illusions.[24]

But Twardowski does not deny the scientific utility of psychophysics. On the contrary, he lends it his support. Thus, the first Convention of Polish Philosophers, held in Lvov in May 1923, took a resolution towards the foundation of the Psychophysical Institute.[25] For Twardowski, this was a further step in separating philosophical psychology and putting forward its specificity.

Before the Second World War, Poland counted many psychophysical laboratories, often attached to institutions and to pedagogical academies. Many Polish "psychophysicists" were active participants in the birth of the discipline at the turn of the century. During the sixth International Psychology Convention in Geneva, there were eight Polish psychologists, five of whom were women! One of them, "Miss. Dr J. Joteyko" was not only the first female member of the convention's organization

[23] *Cf.* Wundt (1893). Here, Wundt analyzes the method of "suggestion" and concludes that it has no value for psychology (among other things, he gives the argument of the limits of personal observation). In contrast, Wundt recognizes the utility of hypnosis in medical practice (especially when it is in accompaniment to medication).

[24] Ajdukiewicz (1913b), p. 284.

[25] *Cf.* "Chronique" dans *Revue Néo-Scolastique de Philosophie*. 25° année, N°100, 1923. pp. 457–470.

committee, she was also the first woman, before Maria Curie-Skłodowska, to give classes at the Collège de France (in 1903). Josefa Joteyko (1866–1928), doctor of medicine and physics, directed an experimental psychology laboratory in Brussels and worked at the Solvay Institute before returning to Poland in 1919.

One discipline particularly, psychotechnics, which studied natural predispositions (or rather lack thereof) for certain professions, saw significant development. One of Twardowski's Ukrainian students, Jaroslaw Cukrowski (1904–1995) would go on to become director of the Institute of Psychotechnical Research in Katowice between 1932–1939.[26]

Conclusion: the "official" dates of creation of the "first" experimental psychology laboratories are not retained by pure chance. In the case of Wundt's laboratory, it is his "scientific strategy" and the launching of a first, and only, project of experimental research, followed by a publication, which, retrospectively, transformed a depository into a laboratory. At the time, this strategy was in keeping with the evolution of the very idea of university which, from a place for the exclusive transmission of culture, was also becoming a place of national research and a source of scientific publications aided by funding from the State.

In Twardowski's case, 1901 was a date which marked the birth of his empirical psychology, in conjunction with psychological experimentation but distinct from the psychology of which the *Institut für experimentelle Psychologie zu Leipzig* became the symbol.

3. Psychology Beyond a "Formal Scholastics of Figures"

Franz Brentano, Twardowski's philosophical mentor, attributed great importance to experimental psychology. He never himself had access to the necessary instruments to practice it. It was thus with impassioned interest that the young Twardowski, benefiting from a grant from the Austrian ministry, headed to Leipzig in the autumn of 1891 to learn "the instruments and methods" of experimental psychology.[27] But Wundt, at the time, gave only a class in history of philosophy. For him, as also for many others, experimental psychology came to be an academic career accelerator. It was thanks to the kindness of Oswald Külpe, Wundt's assistant at the time, that Twardowski could get close to the apparatus and gather information about the workings of the Institute.

[26] S. Ivanyk's doctoral dissertation published as Ivanyk (2014).
[27] Twardowski (1993), p. 14.

Moreover, Twardowski would maintain friendly relations with Oscar Külpe and with his Würzburg school, with which he has obvious affinities (*cf.* the work of Bronislaw Bandrowski 1879–1914).

However, spending time in establishments of experimental psychology was an obligatory step for Twardowski's disciples (with Wundt in Leipzig, G.E. Müller in Göttingen, Stumpf in Munich and Berlin).

The young Twardowski was originally an adept of the Brentanian idea that psychology is the basis of philosophy. This was what he expressed in 1897, when already a professor at Lvov, during a long conference subtitled "Psychology compared to physiology."[28] His presentation brimmed with the time's characteristic enthusiasm for the revolution the development of empirical psychology represented. Thanks to progress in knowledge within psychology, philosophy would finally, Twardowski argued, have the possibility of becoming a universal know-how (*umiejętność*) capable of scientifically justifying its propositions. For Twardowski, psychology must provide philosophy not only with its methodology but also with its object, since all philosophical concepts are psychic creations.

His entire school would abandon this position after an antipsychologist battle fought between 1904 and 1907 by the young Jan Łukasiewicz.[29] But while Łukasiewicz attached a radical criticism of psychology's place in philosophy in general to this refutation of psychologism centered on the justification and status of logic, Twardowski did not turn away from psychology in general. Throughout his career, he never gave up training psychologists and developing research in psychology, deeply convinced that it was psychology itself, psychology as a science, which was the first victim of psychologism. However, it was only in 1911, after he had developed and published his theory of actions and products in "O czynnościach i wytworach," that he found arguments enabling the definitive refutation of psychologism in science.

Because, for Twardowski, criticism of psychologism must not blind us to the fact that we learn the existence of all the properties of psychic products (even their aprioric properties) and, indeed, of the very existence of psychic products themselves "only through intimate experience and the conclusions drawn from it."[30] For this reason, cognitive psychology is an invaluable auxiliary philosophical science, as much for the other philosophical sciences (logic, theory of knowledge, ethics, aesthetics,

[28] Published for the first time in 1927, quoted from (1965), pp. 92–113.
[29] *Cf.* Miśkiewicz (2011).
[30] *Cf.* Twardowski (1913b), pp. 270–271.

etc.) as for the natural sciences: psychology deals with and is part of man's heuristic capacities.

In accordance with his Theory of Actions and Products (APT) Twardowski defines a *psychic fact* as *a concrete unit composed of psychic activity and the product of that activity*.

However, certain *conditions* which accompany psychic facts are not part of psychology. Hence, the analyses of mechanical or chemical impulses underpinning sensations are part of chemistry and physics, with the study of sense organs being part of anatomy and physiology. Twardowski here distinguishes himself radically from the naturalist experimental psychology most of his philosopher-psychologist colleagues espouse.[31] This difference becomes clear in his conceptualization and practice of experimentation.[32]

Twardowski makes a clear distinction between what is "experimental" (*eksperymentalne*) and what is "empirical, coming from experience" (*doświadczalne*) in general. "Empirical," for him, is an adjective which, in its widest sense, encompasses the entirety of all human activity, just like "life." All knowledge and human understanding is in this sense empirical since, in one way or another, it all results from the experience of life. However, "experimentation" is a voluntary procedure, generally qualified in a precise manner and used in science. In this way, Wundt's or Helmholzt's first experiments, insofar as psychology as a nascent science was developing, turn out to have actually been psychophysiological or psychophysical experiments and not purely psychological ones. To consider them as psychological experiments is, according to Twardowski, to not think of the new science according to its true nature, according to what sets it apart; it is to give in to the physiologist or physicalist reductionism specific to psychologism. In an article subtitled: "Psychology without instruments (1912)" Twardowski judges this evolution very sternly.

As for the psychology practiced by mathematicians and physicists, according to Twardowski, it runs the very real risk of becoming a "formal scholastics of figures."[33] Twardowski, here, is explicitly indicating the laboratory work at Leipzig.

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[31] Except for the Würzburg school with which he has obvious affinities, personally supported by the friendly relations he keeps with Oscar Külpe.

[32] We also find here the source of the misunderstanding that Twardowski was hesitant about experimentation in psychology.

[33] Twardowski (1912), p. 321.

At no other time has the risk of psychology becoming a "formal scholastics of figures" been more real than today, in this computational age of ours.

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BRONISŁAW BANDROWSKI. A DISRUPTED THREAD IN POLISH ANALYTICAL THOUGHT[1]

1. Introduction

The objective of this paper is to provide a concise biographical note on Bandrowski's scientific life and to present the most significant philosophical results he achieved. Also, it is meant to critically analyze some of his writings, especially the ones dealing with induction, analytic methods and anti-psychologism, as well as to compare them with the legacy of other thinkers from the Lvov-Warsaw School circle. The paper will be divided into four parts accordingly. Due to its limited scope, the paper will not be exhaustive.

Contemporarily Bronisław Bandrowski, one of the first and most talented pupils of Kazimierz Twardowski, is better known for the circumstances of his tragic death in the Polish Tatra Mountains than for his writings. Born on the 27th of May 1879, he died at the age of thirty-five. While hiking in the mountains near Zakopane he lost his way and got trapped on a rocky ledge. On July 27th 1914 – after nearly three days spent on the ledge – he hurled himself into a precipice. The tragic story of his death became one of the Tatra's legends told by guides in mountain shelters as a warning to tourists.[2]

After Bandrowski's early passing his works were gradually forgotten. Although the Polish Philosophical Society planned to publish all of

[1] The article is a result of the project „The Significance of the Lvov-Warsaw School in European Culture, supported by the Foundation for Polish Science.

[2] *Cf.* Zaruski (1958), Żuławski (1958).

In: Anna Brożek, Alicja Chybińska, Jacek Jadacki and Jan Woleński (eds.), *Tradition of the Lvov-Warsaw School: Ideas and Continuations* (*Poznań Studies in the Philosophy of the Sciences and the Humanities*, vol. 106), pp. 265–278. Amsterdam/New York, NY: Brill | Rodopi, 2016.

his philosophical works and even Kazimierz Twardowski himself was involved in raising funds for the publication of Bandrowski's last work on the psychology of thinking,[3] the turbulent times of the First World War and later the Polish-Bolshevik War made it impossible to realize the plans. The most notably absent is the mentioned work on the psychology of thinking, on which Bandrowski had worked over the last couple of years of his life and which he had planned to be his habilitation dissertation. The work had been left in the form of a manuscript and Twardowski commissioned editing it to his other pupil Stanisław Błachowski, who at the time lived and worked in Poznań. Błachowski's letters to Twardowski show that the first worked on the editing of the manuscript between 1920 and 1926 without completing the work. In 1925 Błachowski informed Twardowski in a letter that he had typed 251 out of about 400 pages of the manuscript.[4] One of the reasons his editing efforts extended over such a long period of time was probably that there were no clear prospects for Bandrowski's dissertation publication.[5] Further history of the manuscript is not known. Had it been returned to Twardowski, it could have survived in the Polish Philosophical Society archives in Lvov. Otherwise, it could have been lost during the Second World War as Błachowski was forced to flee from Poznań and managed to save only a fraction of his library. Regardless, the manuscript was not found during research conducted in 2014 in the archives in Lvov, including the archives of the Polish Philosophical Society. Also, it is not amongst Błachowski's archives in possession of the Polish Academy of Science in Poznań. Although the research for the missing manuscript has not yet been successful, it cannot be ruled out that it hasn't been destroyed and will be found in the future.

Today most of the monographs of the Lvov-Warsaw School either omit Bandrowski's name altogether or mention him occasionally as one of Twardowski's first students without discussing his philosophical and psychological views. Jan Wolenski's monumental monographs on the Lvov-Warsaw School,[6] Jacek Jadacki's book entitled *Polish Analytical Philosophy*[7] as well as Ryszard Jadczak's works *Powstanie filozofii analitycznej w Polsce*[8] and *Mistrz i jego uczniowie*[9] all exemplify this.

[3] *Cf. Gazeta Lwowska* **169**, p. 3.
[4] *Cf.* Stefan Błachowski's letter to Kazimierz Twardowski, 7th of July 1925, e-LV Archive (www.elv-akt.net).
[5] *Cf.* Głombik (1999a), pp. 128–129; Twardowski (1909), p. 424.
[6] Woleński (1985), (1989).
[7] Jadacki (2009).
[8] Jadczak (1995).
[9] Jadczak (1997).

Although Czesław Głombik discussed Bandrowski's works in one article[10] and in one chapter of his book entitled *Husserl i Polacy*,[11] Bandrowski's views still need reminding and further studies.

2. Biography

Bandrowski was one of the first and most talented students of Kazimierz Twardowski in Lvov, and one of the first participants in his philosophical seminar, which became the foundation of the Lvov-Warsaw School. In addition to the studies in philosophy, he also studied mathematics and later classical philology.[12] He was one of co-founders and an active member of Polish Philosophical Society created in 1904. That same year he published his first major dissertation on the methods of inductive inquiry,[13] based on which he was awarded a doctor's degree with highest honors (*sub auspiciis Imperatoris*)[14] in 1905. It is extraordinary that only a few years earlier the same highest honors were awarded to another Twardowski pupil and Bandrowski's friend – Jan Łukasiewicz. In 1905 Bandrowski published his second significant dissertation on the analysis of language.[15] During the 1905/1906 school year he undertook additional studies, first in London[16] and then in Göttingen in the psychological laboratory of Georg E. Müller. However, Edmund Husserl tried to discourage Twardowski's pupil from coming to Göttingen to continue his studies if it was to be motivated by his interest in experimental psychology.[17] Georg Müller was supposedly unwilling to admit visiting students to the psychological laboratory he led. Nevertheless Kazimierz Ajdukiewicz expressed an opinion in a biographical note on Bandrowski that the studies in Göttingen had a tremendous impact on his further interests.[18] Indeed, after 1906 he chose to concentrate entirely on research in the field of experimental psychology and - as it was mentioned before – his last major work to which he devoted the last years of his life, concerned the psychology of thought. However, it is highly

[10] Głombik (1999a), pp. 127–138.
[11] Głombik (1999b), pp. 159–166.
[12] *Cf.* Twardowski (1905), pp. 434-435.
[13] Bandrowski (1904a).
[14] Ajdukiewicz (1935), pp. 256–257.
[15] Bandrowski (1905a).
[16] Syski (1971), p. 15, Stachowski (1992), p. 23.
[17] *Cf.* Edmund Husserl's letter to Kazimierz Twardowski, 3rd of December 1905, e-LV Archive (www.elv-akt.net).
[18] *Cf.* Ajdukiewicz (1935), p. 257.

probable that Müller's influence coincided with the evolution of Bandrowski's methodological views as a result of his own research in field of language analysis.[19]

Certain traits of Bandrowski's character as a scholar need to be underlined. Without any doubt he was a meticulous, demanding and critical reviewer of others' writings. He wrote scathing reviews[20] of Nuckowski's handbook of logic,[21] Doroziński's and Jakóbiec's handbooks of elementary psychology,[22] and Rembacz's work on Plato's ethics.[23] Significantly, Bandrowski most often criticized other authors' works for their lack of intellectual self-dependence, and inappropriate methodology – in the case of psychology it was the analytic method rather than an experimental or observational one – as well as for the wrong didactic approach. Through his criticism Bandrowski expressed his own views on what scientific methods he found proper, as well as on the importance of didactics in teaching philosophy. In this respect Bandrowski's standpoint resembled Twardowski's opinions regarding the utmost value of self-dependence in philosopher's work and the importance of didactics. Bandrowski also frequently pointed out that insufficient attention was paid by the reviewed authors to the results achieved by other researchers – especially foreign ones – which resulted in an incomplete picture given by the reviewed works. He was not overcritical though. In his reviews of some other authors' works, such as Maurycy Straszewski, Jan Władysław Dawid or Georg Müller, he expressed high esteem for their methodology and scientific value. What is more, his reviews were not biased: Nuckowski's later work on learning[24] got a positive review in spite of previous crushing criticism of the same author's handbook of logic.

It is also worth mentioning that Bandrowski applied the same standards to his own scientific work. He attempted to use language as precise as the discussed matter required, rigorously adhered to facts in his reasoning and aimed to take into account all of other philosophers' and psychologist's writings in the analyzed matter. In an introduction to his dissertation on the analysis of language he even felt obliged to explain reasons for not taking into consideration a complete range of writings on the subject matter.

[19] *Cf.* last section of this paper.
[20] *Cf.* Bandrowski (1905b), Bandrowski (1905c), Bandrowski (1904b).
[21] Nuckowski (1903).
[22] Doroziński (1909); Jakóbiec (1910).
[23] Rembacz (1903).
[24] Nuckowski (1908).

Bandrowski's interest in the didactics of philosophy was closely linked to his biography: since 1902 he worked as a teacher in grammar schools in Rzeszów and Lvov. What's more, in 1904 he passed exams and was granted the right to teach propaedeutic of philosophy. From this perspective he was not a typical scholar as he stayed out of University and divided his time between teaching in grammar schools and strictly scientific work: first in the field of philosophy, later in experimental psychology. In an obituary published in "Museum"[25] (a periodical of the High School Teachers Association) Bandrowski's pedagogical achievements were appraised as much as his scientific work. He was indeed an excellent teacher, admired and loved by his pupils, understanding youth and achieving great results in their education. Also, he devoted much of his time to his pupils outside of regular school hours. Undoubtedly, combining intense pedagogical efforts with scientific work required extraordinary discipline. If we also take into account his role as an editor of "Ruch Filozoficzny" and "Museum," his involvement in founding the Polish Philosophical Society and his duties as a board member of the High School Teachers Association, we realize that Bandrowski was an individual of unparalleled energy and activism. Indeed, his short scientific career produced numerous publications. Between 1904 and 1914 he wrote three major dissertations, delivered fifteen addresses regarding philosophical and later psychological problems, wrote seventeen reviews, summarized fifteen issues of "Mind" and the "American Journal of Psychology" and edited three large encyclopedia articles.

According to the commemorative article in "Museum," Bandrowski represented a "refined ethical sense."[26] This sense might be genetically linked with a philosopher's ethos, which was described and realized in practice by Twardowski.[27] This ethos was probably at the root of Bandrowski's care for objectivity and self-dependence,[28] as well as his attention to facts, which motivated his critical reviews of other philosophers' works. The same ethos made him recognize the value of some later writings of the previously criticized Nuckowski.[29]

[25] Obituary (1914/15).
[26] Obituary (1914/15).
[27] Twardowski (1933).
[28] *Vide* Bandrowski (1904b).
[29] *Vide* Bandrowski (1912), p. 611.

3. Two Periods

There are two periods clearly distinguishable in Bandrowski's scientific life. Until 1906, he was mostly interested in philosophy and logic, although his works were marked by Twardowski's descriptive psychology. He published previously mentioned dissertations on induction in 1904 and another one on language analysis in 1905. Also, he gave speeches at the Polish Philosophical Society on logical propositions[30] in 1904 and on scientific normative ethics[31] in 1905. He reviewed the mentioned Nuckowski publication on logic[32] and provided summaries of philosophical articles in *Mind*. His interests in this period – as he pointed out himself in his dissertation on the analysis of language – ranged from metaphysics through epistemology to logic.[33] In his philosophical inquiries he utilized primarily linguistic and logical analyses. Also, he tended to position his philosophical views in opposition to Mill's firm empiricism, which denied existence of any extra empirical factors such as necessity in the causal relation. Unlike Mill, Bandrowski claimed, that constant conjunction is the only part of the notion of causal relation that is derived from experience and it doesn't exhaust the content of this notion. According to him an element of necessity is incorporated into the material given to us in experience as a result of a postulate of our knowledge to understand all that exists as necessary.[34]

After 1906 all of Bandrowski's lectures and reviews were devoted to psychology with only one exception: in 1908, at the Polish Philosophical Society he gave a speech on the relations between notions,[35] which was closely linked to a strictly logical address given by Łukasiewicz back in 1904.[36] Even the summaries given by Bandrowski in "Ruch Filozoficzny" from 1911 solely concerned psychology: he summarized articles published in "The American Journal of Psychology." This shift in Bandrowski's interests was most likely related to the results he achieved in his linguistic analysis as well as to psychological post-doctoral studies in London and in Georg E. Müller's psychological laboratory in Göttingen. It is at least partially under the influence of his studies in Göttingen that Bandrowski finally concentrated on experimental psychology after 1906.

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[30] Bandrowski (1905d). p. 285.
[31] Bandrowski (1906), p. 315.
[32] Nuckowski (1903).
[33] *Cf.* Bandrowski (1905a). p. 1.
[34] Bandrowski (1904a), p. 27.
[35] Bandrowski (1909), p. 213.
[36] Łukasiewicz (1904a), p. 245.

4. Analytical Method

The remaining part of this paper will concentrate on the first philosophical period of Bandrowski's scientific life. A special emphasis will be placed on the most significant amongst his published writings namely his dissertations on induction and one on the analysis of language.

The first of these works, being Bandrowski's doctoral thesis, contains a thorough analysis of the methods of inductive reasoning. In an introductory section, he gives a historical overview of Bacon's, Herschel's, Whewell's, Mill's and Sigwart's views on induction. The second part is devoted to a critical analysis of the intrinsic qualities of induction, Bandrowski's claim being that it always involves the notion of cause. As a result, in order to analyze induction, it is necessary to answer the question concerning the qualities of the notion of cause. To achieve this objective, Bandrowski reaches for an analytical procedure. In the first step, which he frames as a "linguistic analysis," he finds that the cause is not a relation between substances as it was traditionally designated by philosophy. Instead, he proposes understanding the notion of cause in terms of the relation between propositions. He analyzes the properties of this relation to find out that it is necessary and asymmetrical – a certain cause necessarily involves the existence of a result, but not vice versa, the existence of a result does not involve the existence of a given cause. As he admits, this formulation of the notion of cause is inspired by Sigwart's *Logik*.[37] Finally Bandrowski concludes that the notion of cause can be reduced to an implication: "necessarily if A, then B," where A and B stand for existential propositions and the necessity stems directly from the very relation between the antecedent, and the consequent.

The logical reconstruction of the notion of cause is then used by Bandrowski to justify certain further properties of induction. As the necessity is not subject to experience – a view which he developed under Hume's and later Mill's influence – the results provided by induction are merely probable.

The analytical procedure applied by Bandrowski in order to resolve the problem of induction deserves deeper reflection. In fact both methods of analysis which he applies – linguistic analysis and logical analysis - go far beyond the mere decompositional analysis such as it has been used by many modern philosophers. Bandrowski's interest in logical and linguistic analysis was probably inspired by Sigwart, however he has a clear merit of understanding their importance, especially as his dissertation on

[37] Ch. Sigwart (1878), p. 161.

induction was written independently from Frege's and Russell's works. The reception of Frege in the Lvov-Warsaw School started at the earliest in 1910 by Łukasiewicz's mention in his book *O zasadzie sprzecznosci u Arystotelesa*[38] and the celebrated Russell's *On denoting*[39] was published in 1905. Thus, in a certain sense, Bandrowski was one of the first Polish philosophers from the Lvov-Warsaw School circle to anticipate the dawn of modern analytic philosophy.

Bandrowski regarded linguistic analysis as playing a primary role in relation to logical analysis. He wrote:

> (…) I realize that in logic we might not go beyond linguistic analysis, that it is the best source of laws of logic, better and more reliable than the analysis of psychological phenomena, because language is common for entire masses of thinking individuals and allows checking the results of analysis at any time (Bandrowski 1904a, p. 28).

What is more he underlines the universal character of language, which makes it the sole bearer of human knowledge:

> Linguistic analysis has a great significance for knowledge. Language is this special system of signs, in which we need to grasp knowledge in order to make it the common property of the whole of humanity (Bandrowski 1904a, p. 28).

Thus, it seems that Bandrowski perceived linguistic analysis as a legitimate source of knowledge, necessary to build the basis of logical laws. This privileged role of linguistic analysis is due to the fact that language is the only means of communication able to express knowledge in an intersubjective way.

It is worth noting that amongst Twardowski's first pupils, Łukasiewicz also devoted his doctoral dissertation to the matter of induction.[40] This raises a question regarding the reasons which pushed both philosophers to undertake a similar problem. It seems that their interest in induction stems directly from the same source – it is Twardowski's view that the most important advance in logic, owing to psychology, was development in the domain of induction.[41] Incidentally, both philosophers frequented Twardowski's seminar, the one which is believed to have given birth to the Lvov-Warsaw School. The psychological roots of the development of induction were probably doubtful for Łukasiewicz, as he had already rejected psychologism at an early stage of his scientific life.[42] They might have had a certain influence on Bandrowski's views however, at least in Łukasiewicz's opinion.

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[38] Łukasiewicz (1910).
[39] Russell (1905).
[40] Łukasiewicz (1903).
[41] Twardowski (1965), p. 108.
[42] Łukasiewicz (1904b).

5. Anti-Psychologism

In the previously quoted excerpt Bandrowski points out that a linguistic analysis rather than a psychological one brings more reliable results for logic. Also in a later paper on the psychological analysis of the phenomenon of thinking[43] he makes a remark on the beneficial influence of anti-psychologism on logic. He explains that clear separation between psychology and logic made it possible for the latter to develop. But according to him, psychology also needs to get separated from logic in order to develop a theory of thinking. Although Bandrowski's views can be described as anti-psychologistic in some sense, his postulates are to be realized in the domain of psychology, rather than in logic. Most of the thinkers of the Lvov-Warsaw School (including Twardowski and the godfather of strict anti-psychologism in Poland – Jan Łukasiewicz) discussed the removal of psychological elements from logic or philosophy, and not the inverse. Thus his approach to anti-psychologism makes Bandrowski's views original.

Apparently Bandrowski's anti-psychologistic views were not convincing for Łukasiewicz. In his dissertation *Analiza i konstrukacja pojęcia przyczyny*[44] he claimed that Bandrowski came to the same results as he himself did, *i.e.* reconstruction of the notion of cause in terms of implication,[45] although his ideas originated from a psychological basis. It seems that one can doubt if Łukasiewicz's diagnosis was justified. Perhaps due to their friendship he was familiar with some of Bandrowski's views on the role of psychology, which have never been expressed in writing. However it is more probable that they were not radical enough to satisfy Łukasiewicz's extreme reluctance towards applying any kind of psychological analysis in logic. For the same lack of radicalism he criticized Husserl's views[46] expressed in the second volume of *Logische Untersuchungen*[47] and Twardowski's views, even those expressed after the latter declared his anti-psychologism.[48]

In spite of Łukasiewicz's opinion, it was the conviction regarding a need to find a source of knowledge other than psychology that guided Bandrowski's work on his second treatise which was on the analysis of language. It was published only a year after the first one.

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[43] Bandrowski (1907).
[44] Łukasiewicz (1907), p. 60.
[45] Łukasiewicz (1907), pp. 59-60.
[46] *Cf.* Łukasiewicz (1905), p. 470.
[47] Husserl (1901).
[48] *Cf.* J. Łukasiewicz (2013), p. 65.

6. Analysis of Language

After acknowledging the crucial role of linguistic analysis for logic and defining the notion of cause in terms of implication, Bandrowski decided to investigate the cognitive validity of such an analysis. In the treatise on the analysis of language[49] he defines the problem in the following way: what is the value of linguistic analysis for knowledge concerning reality? He starts from characterizing language as a system of signs which refer directly to "extramental" reality rather than to any kind of mental representations. Secondly he points out that the atomic elements of language are propositions reflected in sentences rather than notions reflected in words. Propositions are also basic elements of knowledge, which indicates that both language and knowledge have the same structure.

Having said that, Bandrowski states that, without any doubt, language reflects the real world,[50] at least to a certain degree. However he seeks to determine if the accordance of the language with the real world is strict enough to enable valid reasoning about reality, based purely on language. The answer to this question is negative – in many cases, language and the real world are not parallel. As an example he quotes fallacious results provided by linguistic analysis in the case of the problem of universals. Another argument against the full accordance of language with "extramental" reality involves the existence of many different languages, which must lead to different results of linguistic analysis.

Bandrowski concludes: if the parallel between language and reality is not granted and if we cannot fully rely on linguistic analysis, than it cannot provide any legitimate knowledge. Every result achieved through linguistic analysis would require verification, which in turn would imply cognition of reality through some other, non-linguistic methods. Thus, according to Bandrowski the only legitimate method of cognition is rooted in experience.

7. Experimental Psychology

As it was already mentioned, after 1906 Bandrowski focused nearly entirely on experimental psychology. One can believe that this psychological turn was mainly related to his post-doctorate studies in Georg Müller's psychological laboratory in Göttingen. However, the considerations in

[49] Bandrowski (1905a).
[50] Bandrowski (1905a), p. 48.

Bandrowski's last purely philosophical dissertation on the analysis of language shed a somewhat different light on the development of his thought. If linguistic analyses are the sole basis for the laws of logic and if they cannot be taken as a legitimate source of knowledge about reality, then both linguistic and logical analyses lose their cognitive value. Thus, Bandrowski's interest in experimental psychology may have been motivated by a need to replace them by some other method of examination. However, instead of continuing research based on Twardowski's descriptive psychology he decided to apply methods of experimental psychology, a choice which was probably related to Müller's influence.

If this diagnosis is right, the rupture of analytical thought that is mentioned in the title of the paper was not related to Bandrowski's death. Eight years before the tragic events in the Tatra Mountains one of the analytical threads in Polish philosophy was disrupted by Bandrowski himself, as he rejected linguistic and logical analysis as valid cognitive methods.

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Stepan Ivanyk

STEFAN BALEY AND THE LVOV-WARSAW SCHOOL[1]

1. Introduction

The period of 1895–1939 was the time of the school of philosophy founded by Kazimierz Twardowski. The School, together with the Vienna Circle and the British analytical philosophy school, formed the central pillar of the European analytical philosophy tradition in the first half of the 20th century. In world philosophical literature it has been referred to as the "Lvov-Warsaw School."[2] The definition of the Lvov-Warsaw School, which was intended to "please everyone using the term," was proposed by the Polish historian of science Stefan Zamecki:

> Lvov-Warsaw School" – a group of students of Kazimierz Twardowski, and the students of his students; [...] that is to say, the group of researchers of various specializations working within different periods (the end of the 19th century – the end of the 30s of the 20th century) in Lvov and Warsaw institutionally and ideologically, or at least ideologically, concentrated around Kazimierz Twardowski (Zamecki 1977, p. 35).

A circumstance exists that has not been considered in the research on the Lvov-Warsaw School which might enrich the understanding of its

[1] This artile is a result of the project "The Siginifcance of the Lvov-Warsaw School in European Culture" supported by the Foundation for Polish Science. The article summarizes in English the results of the research on the scientific heritance of Stefan Baley, presented in a series of works I published in Polish and Ukrainian in the period of 2010–2012: Ivanyk (2010), Ivanyk (2011), Ivanyk (2012a), Ivanyk (2012b).

[2] The term had first appeared in the 30s, but came into use within this field after the Second World War. Before that time it was mostly referred to as the "Lvov School" or "Twardowski School," and the "Warsaw School of Logic."

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phenomenon. It is often misremembered that Lvov in the period of the foundation and existence of Twardowski School (1895–1939) was a multinational and a multicultural city – at the time it was the largest center of Ukrainian culture and science. Thus, naturally, questions arise: Did the Lvov-Warsaw School have any influence on the formation of the Ukrainian academic environment of Lvov as it is broadly understood? Can we appoint a person among Ukrainian thinkers of pre-war Lvov, who would belong to the tradition of the school's philosophy? Despite the evident plausibility of these questions, they have not been considered so far either by Polish or Ukrainian historians of philosophy of the first half of the 20th century.

This article is intended to fill this gap partially through the presentation of the academic profile of one of the most eminent of Twardowski's Ukrainian students – Stefan Baley. The approach used for this presentation stems from the definition of the "Lvov-Warsaw School" presented above. According to this definition, the term "Twardowski's student" refers to a person related to the founder of the Lvov-Warsaw School twofold: institutionally (*i.e.* through the relationship with the institutional school's center – the University of Lvov and the University of Warsaw, and the Polish Philosophical Association in Lvov) and ideologically (*i.e.* through the use of theoretical and methodological ideas of the Master in their own work). Hence, in my work I will focus in the first place on the exhibition of the institutional and ideological bond between Stefan Baley and Twardowski and the Lvov-Warsaw School.

2. Institutional Bond

Stefan Baley was born in 1985 in Borki Wielkie village in the Tarnopol district, within the territory of contemporary Austria-Hungary (present day Ukraine). He was a son to a mixed middle-class family: his father, Volodymyr Baley, was Ukrainian, and his mother, Irena Szwejkowska, was Polish.[3] Baley received his secondary school education in Tarnopol, then, until 1907, he studied philosophy in the Faculty of Philosophy at the University of Lvov, mainly under Twardowski's supervision. It was at this university where in 1911 Baley defended his doctoral dissertation "O potrzebie rekonstrukcji pojęcia psychologicznej podstawy uczuć" [On the necessity of the reconstruction of the notion of a psychological basis of feelings] against Twardowski. Further on, within the scholarship of the

[3] Mixed Ukrainian-Polish families were common at that time among the people of Eastern Galicia.

Austrian ministry of education he spent two years as a student assistant at the University of Berlin (under the supervision of Carl Stumpf and Karl Schäfer) and Sorbonne (under George Dumas).

In the Lvov period of his academic and pedagogic career, Baley devoted himself primarily to the development of Ukrainian academics: with minor breaks, he worked as a teacher at Ukrainian-language secondary schools in Przemyśl, Tarnopol, and Lvov for twenty years (1908–1928), and between 1920–1925 he gave lectures on logic, psychology, and the introduction to philosophy at the Secret Ukrainian University in Lvov. Among his students were notable Ukrainian figures in science and culture of the 20th century (*e.g.* the psychologist Yaroslav Tsurkovs'kyi, the philologist Stefan Shakh, the composer Mykola Kolessa and many more). Simultaneously, Baley remained in a close relationship with the Polish academic environment in Lvov: *i.e.* he enthusiastically partook in the scientific research of the organizational offshoot of the Twardowski School – the Polish Philosophical Association in Lvov. In 1925, driven by his initiative, a psychology section of the Association was created, of which Baley became the supervisor.

That year Twardowski initiated the practice of the habilitation of his Ukrainian students at the University of Lvov. Unfortunately, Baley's activities related to the Secret Ukrainian University obstructed the realization of this pursuit. Due to the fact that the above mentioned institution was illegal at the time, owing to the Ukrainian loss in the Polish-Ukrainian War (1918–1919), Lvov professors expressed apprehension toward supporting the Ukrainian philosopher for a position at the University of Lvov, which might have been perceived by Polish society as a support of antinational trends. Having encountered fierce opposition from many professors at the University of Lvov, Twardowski decided to carry Baley's habilitation forward to Warsaw. At the University of Warsaw, Ukrainian-Polish political tensions were not as noticeable as in Lvov, and among the university's professorial staff a number of Twardowski's eminent former students had already been active – Jan Łukasiewicz, Stanisław Leśniewski, Tadeusz Kotarbiński, Władysław Witwicki. The latter took the role of a lobbyist for Baley's candidature to the head of the Department of Educational Psychology of the University of Warsaw. He wrote to the rector of the University:

> As a scholar [Baley] worked for the cultural growth of the Ukrainian people and increased the academic achievements of Poland [...] Acquiring this individual for the scientific research at the University of Warsaw should be considered a true and great benefit to our culture (Witwicki 1926, p. 30).

Eventually, thanks to Twardowski's and Witwicki's long efforts, on January 1st, 1928, Baley was officially appointed a contract professor (from October 16th, 1928 – an associate professor, from October 17th, 1934, a

full professor) for the head of the Department of Educational Psychology of the University of Warsaw.[4] In a letter to Twardowski sent shortly after the nomination, Baley wrote:

> But now I can tell myself that what I have always dreamed of has come true [...] And I tell myself many times, the realization of my dream I can owe only to your kindness and protection.[5]

At the University of Warsaw, Baley straightway undertook lively didactic, editorial and organizational activity, which he pursued until his death (he died in Warsaw on September 13, 1952). Baley focused mainly on the creation and organization of the work of the research team at the Institute of Educational Psychology. Affiliated with the Institute, he created, among others, centers of school psychologists, kindergarten psychologists, mental hygiene, pedagogical workshops, psycho-technical workshops, *etc*. He instructed many prominent Polish psychologists, such as Joanna Kunicka, Ewa Rybicka, Ludwik Goryński, Maria Żebrowska and many more. Over the whole Warsaw period, he remained the staff writer of "Polskie Archiwum Psychologii" [Polish Archive of Psychology], a quarterly journal (since 1938 – "Psychologia Wychowawcza" ["Educational Psychology"]). Professor Baley presented the results of his work at numerous congresses and international conferences (Utrecht, Copenhagen, Brno, Moscow, Paris, London, Edinburgh, Stockholm, *etc*.), and numerous scientific publications, written, in addition to Polish and Ukrainian, also in German, English, French, and Spanish.

3. Ideological Bond

As soon as the Lvov period of his scientific pursuits began, Baley started to specialize in psychology. The three main directions of his psychological studies of the time can be distinguished.

First of all, these were studies in accordance with Brentano's descriptive psychology, focusing mainly on the theoretical analysis of emotion considered as one of the basic categories of psychological phenomena. The most important work in this regard was Baley's doctoral thesis "O potrzebie rekonstrukcji..." [On the necessity of reconstruction...] published in

[4] Interestingly, the Ukrainian citizens of Lvov have spread the rumor that Baley moved to Warsaw for romantic reasons: that he supposedly had fallen in love and married some female professor at the University of Warsaw. In fact, Baley remained bachelor all his life.

[5] Kazimierz Twardowski archives in the Joint Libraries of UW WFiS, PAN IFiS, and PTF, K 15–12, p. 16.

Ukrainian in 1911 and edited in German in 1916. The subject of Baley's analysis was the concept of "the psychological basis of feelings," which in the beginning of the 20th century served as an ethical-psychological and aesthetical foundation for theories by Alois Höfler, Aleksius Meinong, Robert Saxinger, Stephan Witasek and other representatives of the Brentanian philosophical tradition. As a result of the thorough and detailed analysis of this concept which Baley conducted, he was able to state that it was characterized by a logical inarticulateness and was used indecisively; so it should be fundamentally modified. It should be underlined that the German-language version of Baley's study faced noticeable response from the Brentanian environment. In his work "Zur Grundlegung der allgemeinen Werttheorie" [On the basics of a general theory of value] (1923), Meinong referred to Baley's critique, which had slightly changed his beliefs on the nature of the psychological basis of feelings.[6] Within the Twardowski School itself, the analysis of feeling originated in Baley's work was continued in the works of Salomon Igel[7] and Bohdan Nawroczyński.[8]

The second course of Baley's psychological research during the Lvov period should be considered psychoanalysis, which Baley practiced as a doctor in his work at the Department of Neurology and Psychiatry at the Public Hospital in Lvov (1923–1927) as well as in treating patients at his home. Baley's interest in psychoanalysis was expressed also in his theoretical work concerning the use of psychoanalysis in the interpretation of Taras Shevchenko's and Julisz Słowacki's literary works. The theoretical research on Shevchenko's artistic production is included in publications such as "З психології творчості Шевченка" [From Shevchenko's creativity psychology] (1916) and "Трійця в творчості Шевченка" [The trinity in Shevchenko's work] (1925), and the research on Słowacki in "Psychologiczne uwagi o genezie poematu Słowackiego *W Szwajcarii*" [Psychological notes on the genesis of Słowacki's poem *In Switzerland*] (1921) and "Psychoanaliza jednej pomyłki Słowackiego" [Psychoanalysis of one of Słowacki's mistakes] (1925). The pursuit to discover the relationship between subconscious complexes and the artistic creations of these poets Baley approached quaintly: instead of using the applicable concepts of Freud and his followers, he introduced the new idea of the "Endymion motive." All fantasies characterized by the Endymion motive have a common scenario, according to which the lover remains passive towards his love, and only falls for her when she comes to him and hurls herself into the lover's arms. Analyzing selected

[6] Meinong (1923), pp. 169–170.
[7] Igel (1919), pp. 352–418.
[8] Nawroczyński (1920), pp. 206–225.

parts of Shevchenko's and Słowacki's poems, Baley was able to recognize the signs of typical Endymion motives in them.

The third important course that Baley was occupied with at the time was the psychology of music. Practice in Berlin under Stumpf resulted in the publication of a dozen or so publications of the Ukrainian scholar within this scope in prestigious German-language scientific journals ("Zeitschrift für Psychologie" ["Journal of Psychology"], "Zeitschrift für Sinnesphysiologie" ["Journal of Sense Physiology"], and "Beiträge zur Akustik und Musikwissenschaft") ["Posts on Acoustics and Musicology"]. Baley's works in this field focused mainly on the experimental investigation of the conditions of the psychological perception of the harmony of different sounds and a theoretical generalization of the obtained results.

An upsurge in Baley's scientific creativity came in the Warsaw period. The most important of his works at the time should be considered a number of educational publications: "Psychologia wieku dojrzewania" ["Psychology of Puberty"] (1930), "Zarys psychologii w związku z rozwojem psychiki dziecka" ["A Sketch of Psychology in Relation to the Psychological Development of the Child"] (1935), and "Psychologia wychowawcza w zarysie" ["A Sketch of Educational Psychology"] (1938). In the former of these publications, the author was occupied with a precise definition of puberty and a division of puberty into shorter periods with an establishment of the psychological symptoms characteristic to each of these periods; in the second – he conducted a thorough analysis of the development of psychological operations among children (sensual impressions, reminders, reasoning, feelings, volitive acts, *etc*.); in the latter – he distinguished educational (or pedagogical) psychology as a branch of applied psychology, determining its subject, tasks, and methods, and presented the problem of the specificity of psychological processes involved in the process of upbringing, especially focused on the analysis of the phenomenon of learning. Baley's intention was to make his last book (considered by many researchers to be his magnum opus) "the program and the announcement of what [in Polish educational psychology] should be."[9] It is by this circumstance that Baley is deservedly considered the founder of Polish educational psychology.

Baley based all the publications named above on an enormous amount of research conducted by contemporary Western psychologists and to a great extent on the research conducted by himself in the Department of Educational Psychology at the University of Warsaw. Those publications have lived to see several editions, and have been a help to several generations of Polish psychologists, but most of all to school teachers.

[9] Baley (1958), p. XV.

As far as Baley's publications presenting his original ideas are concerned, the top position should be reserved for the monograph "Osobowość twórcza Żeromskiego (Studium z zakresu psychologii twórczości") ["The Creative Personality of Żeromski. The Study of the Psychology of Creativity"] (1936). This work was created pursuant to a series of lectures Baley had given at the University of Warsaw in 1929/1930 titled "Twórczość S. Żeromskiego jako problem psychologiczny" ["S. Żeromski's Creative Work as a Psychological Problem"], but it can be perceived as a continuation of the research Baley had conducted earlier in Lvov, which concerned the psychoanalysis of literary works. As contrasted with the works by Shevchenko and Słowacki, in the psychological interpretation of Żeromski's writings Baley applied a more elaborate research tool: alongside Freudian Oedipus and Electra complexes, he used the concept of "perseverance" (a characteristic psychological feature of the schizothymic personality, which constantly preserves in the mind some specific psychological content) worked out by Ernst Kretshmer and Gerchard Pfahler, and the concept of "synesthesia" by Erich Jaensch (the inclination to merging in the mind, psychological phenomena of different types).

4. Results

Baley's biographical sketch bears testimony to his undeniably strong relation with all three institutional pillars of the Lvov-Warsaw School: he studied philosophy and completed his doctoral thesis under the supervision of Twardowski at the University of Lvov, partook in and led the psychological section of the Polish Philosophical Association in Lvov, he was also the professor and the head of the Department of Educational Psychology at the University of Warsaw.

As far as Baley's ideological bond with the Lvov-Warsaw School is concerned, at first glance it appears not to be explicit for it possible to differentiate four main, and quite divergent, domains of Baley's psychological work[10]: descriptive psychology, the psychology of music, psychoanalysis, and educational psychology. One might say that in the first three domains, Baley could appeal to three great masters: Twardowski (descriptive psychology), Stumpf (psychology of music), and Freud who he never

[10] Baley also took up the history of philosophy, logic, ethics, the psychology of colors and shapes, the psychology of gender, social psychology, *etc*.

had a chance to meet (psychoanalysis).[11] The fourth domain – educational psychology – Baley mastered himself, and helped develop numerous notable students. And still within the confines of all four domains it is the Lvov-Warsaw School master who had the greatest influence on Baley's scientific creativity. It is Twardowski who played the biggest role not only in Baley's scientific life, but also in the shaping of his student's theoretical and, most of all, methodological base. In an article issued at his mater's 70th birthday, Baley wrote precisely:

> [Professor Twardowski] would always instill us, the students, with the idea that all psychological research would be of value as long as it stemmed from mental presumptions and concluded in a proper interpretation of results. Precision and cohesiveness are obligatory to a psychologist who conducts research, presents it to others, and draws conclusions from it (Baley 1936, p. 66).

Now, Stefan Baley, both in respect of the institutional and ideological bond, performs all the formal conditions of being considered a member of the Twardowski School, and the entirety of the work of the Ukrainian philosopher remains an important and voluminously original addition to the overall scientific reservoir of the Lvov-Warsaw School.

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[11] It should be noticed that all three mentioned philosophers shared a common philosophical lineage: they were the students of Franz Brentano.

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Natalia Miklaszewska

CLASSIFICATION OF MENTAL ACTS IN WORKS OF KAZIMIERZ AJDUKIEWICZ

1. Introduction

Without a doubt, the theory of mental acts has, since the times of Plato, been a traditional part of philosophy. However, a real interest in it was showed by Franz Brentano who brought the 'barbarous period' to an end. Brentano was the first to indicate the need to compose a classification of human mental acts based on a precise and clear analysis of predicates representing psychological processes. Nearly 20 years later, philosophers of Lvov-Warsaw school elaborated on the theory of the classification of mental predicates, which resulted in a profound analysis of the issue in question and created a sound basis for further investigations. The primary purpose of this paper is to outline the theory of Kazimierz Ajdukiewicz. This shall be done for three reasons. Most of all, his theory poses a peculiar 'golden mean' of all the ideas followed and developed by philosophers belonging to the Lvov-Warsaw school. Secondly, apart from elaborating on a standard classification of mental acts, Ajdukiewicz remains a founding father of another classification which goes beyond the standard thinking about mental processes and is based on the theory of syntactical categories. Finally, in spite of the fact that recent philosophers are apt to somewhat neglect the problems of classification of mental acts and categorial grammar, Ajdukiewicz's theory shows that this subject is not devoid of importance and should not be ignored by those who dream about the scintillating development of philosophy and psychology. The aim of this paper is to present and comment on the main ideas of the classification of mental acts proposed by Ajdukiewicz, and moreover to draw a sketch of it and apply it to some issues of the theory of classification in general.

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The main source for this study is (Ajdukiewicz 1938). I make use also of his other works, collected in (Ajdukiewicz 1960) and (Ajdukiewicz 1965), i.a. of (Ajdukiewicz 1935), as well as many Ajdukiewicz's remarks scattered in (Ajdukiewicz 1974).

2. Characteristics of Mental Acts

The primary issue raised by Ajdukiewicz is to recognize the dissimilarity between mental and physical states. Every human activity consists of physical actions and mental acts, yet mental acts remain a motive force of physical actions. Ajdukiewicz indicates a few features of mental acts:

(1) Most of all mental acts take place in time but not in space, as opposed to physical acts which are spatiotemporal (Ajdukiewicz believes that the physical sphere is the 'material' basis of mental acts, but we shall not find those areas identical).
(2) Mental acts can be perceived (sensed) only by one person as opposed to physical processes which can be observed by many people at the same time.
(3) Mental acts are always subjective, which means that they do exist only if they remain as the content of someone's consciousness – as opposed to physical phenomena which are of an objective nature (a tree itself will never be a part of someone's consciousness, unlike the perception of that tree).

I believe we should shortly elaborate on how Ajdukiewicz understands the issue of 'being he content of consciousness.' The philosopher indicates two elemental meanings of the concept of consciousness in reference to mental acts. It seems that if an act remains the content of consciousness, it is situated in the area of consciousness. We are conscious of our mental acts because we experience them but there is no need to pay attention to them; just as the flame of a candle lightens things around, it is also bright itself, even though it doesn't lighten itself. Let us make things more precise and differentiate between two ways of understanding of the aforementioned notion:

(1) *A* is conscious of *y*, if *A* pays attention to *y*.
(2) *A* is conscious of *y*, if *A* experiences *y*.

In both cases the scope of a variable *y*, covers a class of psychical phenomena, which is connected with the distinction between content and an object of mental acts. One cannot experience a train, as opposed to an image of that train, as it is impossible to experience physical objects.

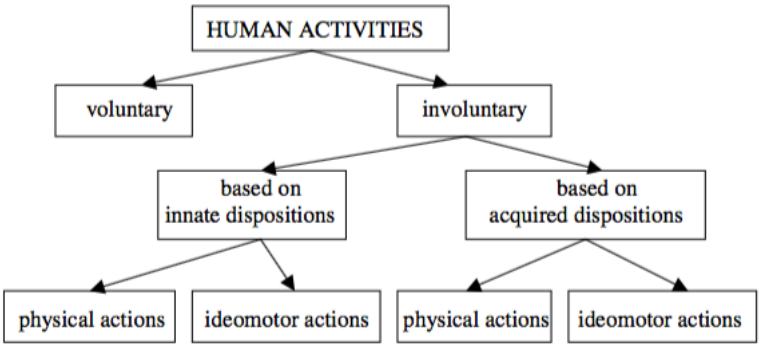
Paying attention is necessary for (a) but not for (b). Furthermore in order to be conscious of something in the (a) sense, one must be conscious of something in the (b) sense. But what about acts which are experienced unconsciously? In order to answer this question, we should refer to the above mentioned notions of consciousness which pose a foundation of two meanings of unconsciousness. And so the first one indicates phenomena that are 'situated' beyond the area of consciousness. The second one means paying no attention to a particular psychical phenomenon. Using the notion of unconsciousness in reference to mental life is very problematic. As long as we understand 'being unconscious' in the second meaning, it is somewhat possible to attribute unconsciousness to mental acts. Sometimes we do not pay attention to what we experience. Yet we are conscious of it as long as it appears in the area of our consciousness. This generates a kind of logical incompatibility, as we are conscious and unconscious of a mental act at the same time. Therefore, using the notion of 'unconsciousness' (in the first meaning) in reference to mental acts is incorrect. The use of the second meaning of unconsciousness in reference to mental acts is also questionable, as if something remains a mental act, it necessarily has to be 'situated' in the area of consciousness.

3. Two Core Classifications of Human Activities

Ajdukiewicz presents the reader with two basic classifications of human activities. One of them is inspired by a traditional philosophical approach and the second one, by a traditional psychological approach. Regarding psychology, one can traditionally classify human mental activities into involuntary and voluntary ones. The main characteristics of voluntary activities comprises the idea that we are aware of them to some extent and that we consider ourselves as their agents which means that if we want we can deter ourselves from performing them. Involuntary activities can be performed either consciously or unconsciously but without a feeling of being the doer of an action or having the possibility not to perform it. The example of such an activity may be an urgent need of satisfying hunger or a pupil shrinking under the influence of light as opposed to movements of your hand in order to grasp a pencil or waving to your friend while greeting him or her, which are the examples of voluntary activities. Even though the above mentioned classification is based on a traditional understanding of psychological and philosophical approaches, its validity is questionable. Most of all, it is hard to draw the line between the two above mentioned classes. The feeling of remaining the conscious doer of an action or of having the ability to stop the action whenever one wants appears in various

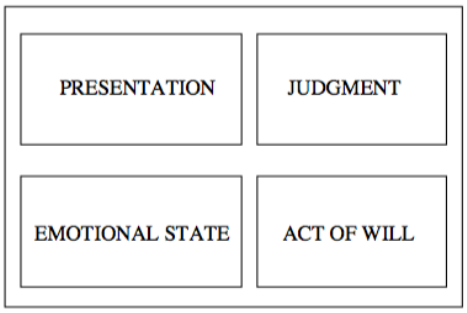
degrees and therefore it is hard to indicate the clear border between them. Moreover one might think about such activities which are voluntary and involuntary at the same time. The example of such an activity is raising your hand while voting in order to scratch your nose. Someone else, however, may interpret this movement as intentionally casting a vote. This activity seems to be voluntary and involuntary at the same time which again proves that there is no clear border between those two classes. Nevertheless there is still a strong need to indicate that border. This may be of major importance for ethics, especially when it comes to the responsibility we take for our actions. Voluntary actions would be the ones we are responsible for, as opposed to involuntary actions, for which one should not bear any responsibility. As a consequence we may classify human activities into those we are and we are not responsible for.

Involuntary actions are divided into (a) those which are *based on innate dispositions* and (b) those which are *based on acquired dispositions*. The main difference between innate dispositions and acquired dispositions is that the first ones appear in human beings somewhat intrinsically, as opposed to acquired ones which appear as a consequence of particular external circumstances. We may also distinguish between *ideomotor* involuntary actions and *physical* involuntary actions. Physical involuntary actions are caused by physical factors, without any psychological interference (*e.g.* intestinal peristalsis), whereas ideomotor involuntary actions are caused by psychological actions (*e.g.* a blush caused by a feeling of shame). After juxtaposing the elements of the above mentioned classification, we may present the following schema:



4. Classification of Psychical Actions

Let us now elaborate on the classification of psychical actions rooted in the traditional philosophical approach. According to that approach, mental acts fall into four separate classes: presentations, convictions, acts of will and emotional states. That brings to mind all the traditional divisions and classifications created by philosophers of the Lvov-Warsaw School and is undoubtedly inspired by the theory of Kazimierz Twardowski. It is worth noting, however, that Ajdukiewicz stands up for a holistic approach towards mental acts, which is quite innovative and unusual taking into consideration the traditional approach of the Lvov-Warsaw School. The philosopher indicates that one mental act consists of all of the above mentioned components. Despite the fact that each time we concentrate our attention only on, say, an act of will or a presentation, it does not mean that other elements are not present in a particular mental act. This view, unlike the views of Ajdukiewicz's predecessors who used to analyze every element in isolation, shows a human being as a multidimensional and sophisticated creature.



Let us now elaborate on each of those elements, starting with presentations.

4.1. *Presentations*

The simplest elements of mental acts are presentations which may be further divided into visual presentations (images) and non-visual presentations (notions). Presentations are always expressed by names. It is clearly visible that Ajdukiewicz shares Twardowski's thesis concerning that issue.

4.1.1. *Content and Object of Presentations*

In order to elaborate on both, the content and the object of presentations it is necessary to introduce the notion of intentionality. The idea of intentionality has its roots in the theory of Brentano, who elaborated on that, and grew the seed of interest in this area. How is that connected with the object and content of presentations? In order to answer that question let us start by saying that the bedrock of Brentano's theory is the idea that every mental phenomenon has its object towards which it is directed. According to Brentano, mental acts fall into three classes: presentations, judgments and phenomena of love and hate. Referring to that we may say that in acts of presentations, objects are presented, in acts of judgments, objects are judged, and in acts of love and hate, objects are loved or hated. Because of the fact that presentations are considered to be the basis of other mental phenomena, every object has to be presented in order to be judged or loved or hated. However in every type of mental phenomena, an object is treated in a different way. In judgments, for example, an object given by a presentation can be accepted or rejected and every judgment may be presented in the existential form "A is" (if it is positive) or "A is not" (if it is negative). In both cases "A" is an immanent object given by a presentation. Both notions, namely, the 'immanent' object, as well as the object in general, are of an ambiguous character. The main problem is where an object is situated. Inside of me or outside of me? If it is situated inside of me, it means that it is a kind of mental entity. If so, how is it possible to reject an immanent object? If I say that *x* does not exist, and I perceive *x* as an immanent object, it means that I reject something that has already existed in my consciousness. How can that be correct if I have rejected something that has already appeared? If I utter such a judgment, it means that it is false. Because of that reason, we should agree that we can accept or reject something that is situated outside of us. But on the other hand if I reject something, still something has to be there for me in order to make it possible to affirm that it does not exist. As we can see, there is a huge degree of ambiguity in Brentano's theory. Twardowski, as one of Brentano's students, decided to engage in the debate about this issue and soon noticed that the reason of the aforementioned ambiguity is as follows: Brentano identified the notion of the object with the notion of content. Because of the fact that there is a huge difference between those two notions, Twardowski decided to clarify the exact relationship between them.

The first presupposition that was supposed to cure the idea of objects, is that there are no objectless presentations. This means that every presentation has its object, no matter how bizarre and strange it can seem. Except for an object, each presentation has also its content. Those two

presuppositions opened the way to a very rich ontology and a new attitude towards a Brentanian understanding of what is presented. The above mentioned distinction enabled Twardowski to formulate the following thesis: every mental phenomenon has its object and its content, and furthermore it is directed towards its object, not towards its content. On the basis of this distinction it was possible to clarify Brentano's notion of 'object immanence' by identifying it with content, as opposed to the notion of an object of a presentation in general which should be recognized as a Brentanian object in general. In order to make things easy, an object is that which is presented, whereas the content is that through which the object is presented. One of the strongest arguments for the validity of that thesis is that we can have two (or more) different presentations concerning one object. The presentation of Roman Juvavum and the presentation of a birthplace of Mozart differ. They have different content but the same object – Salzburg. Such presentations are called by Twardowski interchangeable presentations. We may refer to a metaphor of an arrow directed to an object. Content is like the way the arrow is pointed at the object. The object is what the arrow is pointed at. Interchangeable presentations are like two arrows pointed at the same object.

4.1.2. *Perception*

Taking into consideration traditional scrutiny, Ajdukiewicz distinguishes between two types of perception: an internal one and an external one. Acts of perception are present in our lives almost all the time, except for moments of sleeping or lack of consciousness, and constitute a basic form of presentations. Nevertheless it seems to be extremely hard to decide about their real nature and understand their essence. The external act of perception may be described as a process of using our senses in order to investigate things and physical processes. Internal acts of perception (introspection), on the other hand, are processes of paying attention to mental acts taking place inside of us. Both types of perception may remain a bedrock and foundation of convictions.

4.1.3. *Images*

Images constitute basic components of perception. If one observes a house, they may also notice windows, walls, a roof, grass in front of that house, trees growing behind it *etc*. Each of these elements may be further divided into other images. And so, when looking at the tree behind the house, we may distinguish leaves, a trunk, branches, *etc*. Usually one perception consists of many images, yet it sometimes happens that a perception can be identical to an image, like in the case of a cloudless sky.

Among the types of images, we should list perceptual (primary) images and secondary images. Perceptual images appear at the moment of having a glance at things. They start to exist in the area of consciousness through the senses, so they do appear in a direct way. Therefore a perceptual image is an actuation or a re-presentation of things while looking at them, listening to them, touching them, *etc*.

However perceptual images (or visual presentations) are not the only type of images. Sometimes, in our daily life, we are able to remind ourselves about some past events or things, and later allow this process to become the mainstay of judgments. While sitting in my room, I am able to imagine everything I have ever seen, like for example the Massai lodge in the middle of the jungle or a hut in the mountains. It is beyond any doubt that this quasi-image will not contain all the details one would be able to see in reality, yet still it will remain somehow similar to the content of perception one had seen before. This kind of content may be called a secondary image. The main difference between perceptual and secondary images consists in the so-called *stigma of presence*. Taking into consideration our example, in cases of perceptual images I am willing to accept the conviction that the hut in the mountains indeed is present in front of me, while in the case of secondary images it is impossible to accept this kind of conviction. The second difference is the necessity of stimulus appearance. In fact secondary images may (but do not have to) appear in our mind without the necessity of the appearance of stimulus. They may appear without any reason.

Both types of images may be divided into two classes: descriptive and generic. According to Ajdukiewicz, all types of those images can be delineated as follows:

(1) Perceptual images in the generic sense which are the result of stimulus' direct influence on the senses.
(2) Perceptual images in the descriptive sense - all the perceptions which contain a stigma of presence in their content *i.e.* hallucinations and dreams. It seems for us that they are present, yet they are devoid of a stigma of presence in their origin (and therefore they behave like secondary images).
(3) Secondary images in the generic sense which are not the result of stimulus' direct influence on the senses.
(4) Secondary images in the descriptive sense – all the presentations based on content devoid of a stigma of presence.

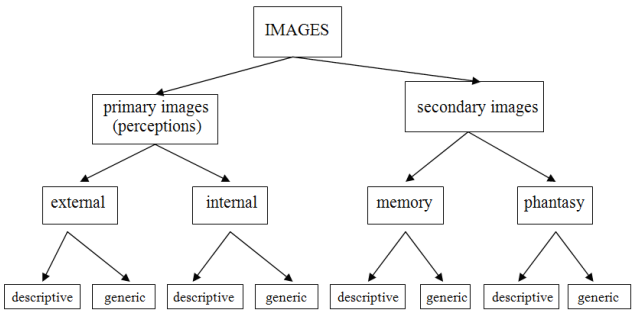
Furthermore among secondary images, one can distinguish between: memory images (re-creational images) and fantasy images (creational

images). If we combine both classifications of secondary images, the outcome may be described as follows:

(1) Secondary memory images in the generic sense – secondary content of an image is more less the same as the content an image possessed by a person some time ago.
(2) Secondary fantasy images in the generic sense – secondary content of an image is not the same or even similar to the content of an image possessed by a person some time ago.
(3) Secondary memory images in the descriptive sense – appear in the consciousness of a person together with the impression of knowing the object of an image. The person has the feeling that they have imagined that object before.
(4) Secondary fantasy images in the descriptive sense – a person has no feeling that they had imagined the object of an image before.

In the majority of cases, memory images in the generic sense are identical to memory images in the descriptive sense, yet there are some situations when memory images in the generic sense are identical to fantasy images in the descriptive sense. The example of such a situation might be unconscious plagiarism. An author may have a strong conviction that the work-of-art is their own product but in reality they had seen something similar before and used it in their work of art without realizing it at the moment of writing or painting.

Without any doubts Ajdukiewicz created a sophisticated classification of presentations. The only issue that is quite bizarre is the place of senses in this classification. On one hand it seems that senses are one of the classes of presentations, however on the other hand one could have an impression that they are rather stimuli of presentations. Taking into consideration the way Ajdukiewicz writes about senses, one could suspect that they are rather elements of each presentation, not a separate class. Yet, it is hard to be sure of that. The graph below shows the classification of images in the theory of Ajdukiewicz:



4.2. *Convictions*

4.2.1. *Sources of Convictions*

According to Ajdukiewicz, it is hardly possible to find any presentations in isolation. In the majority of cases – if not always – they appear as elements of cognitive states, emotions or acts of will. Let us concentrate for a while on cognitive states. *A* is in a cognitive state when *A* gets a conviction *y* about something. All the cognitive states are expressed by affirmative sentences – never by interrogatives or imperatives. According to Ajdukiewicz we can define judgments as thoughts (that might be expressed by means of affirmative sentences) about one's internal conviction describing a particular state of affairs as true or false. Judgments and convictions appear in our mind suddenly. However they do not stay for long. They die even faster than they appear. Even though the moment of conviction is short, transitory and sooner or later will be 'lost in time, like tears in rain,' it is significant for us as human beings. There are four ways of getting convictions:

(1) By experience – my convictions are based on what I see, hear, feel, *etc*. For example: "my neighbor living next door, washed his car." The source of this sentence is what I saw outside the window a moment ago.
(2) By memory – convictions based on what I remember about past events and past convictions. What I remember is the source of one's new judgments.
(3) By inference – convictions as the result of other convictions considered by the subject as true.
(4) By evidence – convictions as *a priori* judgments. The only condition of evident judgments is to comprehend the sentence as the expression of a judgment. The example of evident conviction might be: everything that is red is also colorful. One does not need any experience, memory or inference to understand that the above stated sentence is true. The sentence is true by virtue of evidence.
(5) By the power of authority and the influence of other people – judgments as the result of the acceptance of other people's views. The only condition for considering a sentence as a true, is trust. We simply take it for granted that if *A* says that *x* is true, *x* is true. Yet sometimes it happens that we accept sentences expressed by people who are not authorities for us. The example might be the situation when we hear somebody shouting "Fire!" Despite the fact that we do not know the author of that sentence and we cannot be sure that

something bad is happening, we leave the building as soon as possible, as we believe that the sentence is true.

(6) By emotional factors – judgments as a result of our willingness to make reality appropriate to our desires. We are apt to believe in what excuses our actions and desires, what proves that we and our friends are better than other people, what casts suspicion on our enemies and people we do not like.

None of the above mentioned ways is certain. Never can we be sure that our judgment is true. It has to be stated, however, that the least certain are judgments based on emotional factors and as the most dependable we might consider judgments based on experience and inference.

4.2.2. *Classification of Judgments*

First of all let us expound on a little confusion connected with the meaning of "judgment." We might undoubtedly use this notion in reference to our cognitive processes, thoughts, convictions *etc*. that appear in our mind, yet it is possible to use this term also in logic. Those two meanings should be contrasted. Therefore Ajdukiewicz presents us with definitions of both notions. Judgments in the psychological sense are thoughts which are the psychological meaning of sentences whereas judgments in logical sense are thoughts which are the linguistic meanings of sentences. Let us take into account the following sentence: "Earth is spherical." There is only one linguistic meaning of this sentence; therefore there is only one logical judgment about it. Everyone who speaks a particular language knows this meaning, and moreover this meaning will remain the content of thought which is a logical judgment of this sentence. Nevertheless one sentence can be associated with various thoughts, convictions, perceptions, feelings, depending on who the subject of a judgment is in a particular moment. Thoughts concerning the sentence and located in our consciousness are different each time. That means that the psychological meaning of this judgment is also different according to the circumstances.

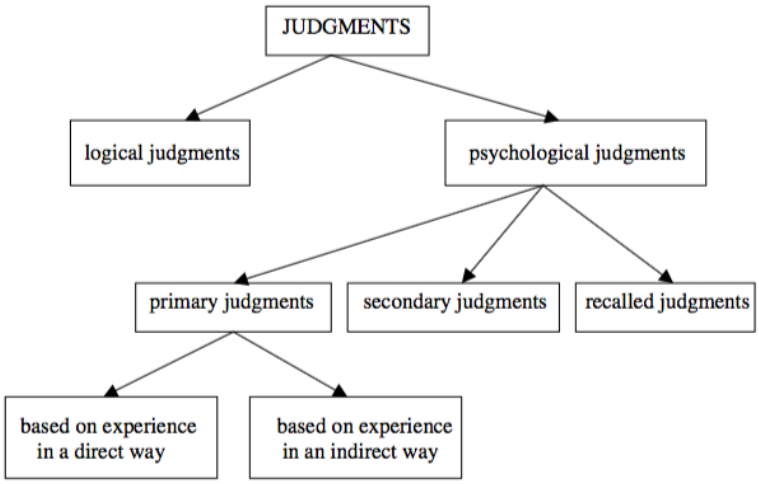
Ajdukiewicz examines psychological judgments extensively and indicates few classes that should be specified. The first class of psychological judgments is that of *perceptual judgments* based on perceptual images. It may be said that the foundation of perceptual judgments is what I see, hear or feel by means of the senses. Perceptual judgments can be divided into two groups: those based directly on experience and those based indirectly on experience. Trying to elucidate judgments founded directly on experience, we have to admit that they do express what one can see, hear *etc*. In case of judgments based indirectly on experience, the whole process is more complicated. If I say 'my friend is at home' because I can see

the light in his window while passing the street, we cannot perceive this judgment as based on experience in a direct way. I cannot see my friend at home, only some light in his window.

Another type of judgment is a *secondary judgment*. This kind of judgment is based on secondary images. In order to create this kind of judgment we must be more or less certain that an image we remember is quite similar to the original object. Even though perceptual judgments and secondary judgments might be of the same logical value, there is a significant difference between them. Perceptual judgments are expressed by positive sentences in present tenses while secondary judgments are expressed by positive sentences in past tenses. Secondary judgments disclose the existence of objects as having passed. It is possible to perceive objects in such a way by using only secondary judgments. It often happens that judgments based on secondary images are false. There are two reasons for that: (a) the secondary image can never be as detailed as the perceptual image (b) even if the secondary image is very similar to the perceptual image, the perceptual image could be defective and could become the source of false conviction.

There is one more type of judgment, namely: *recalled judgments*. They appear when we remember judgments that we once had. There is no need to perceive an object or recall a secondary image in order to bring a secondary judgment about. The only thing that we need is a strong conviction about the truth of the past judgment we recall. It seems that recalled judgments are equivalents of suppositions described earlier by Kazimierz Twardowski and Władysław Witwicki. While a necessary condition of other types of judgments is assertion, it is needless in the case of recalled judgments. Shall this interpretation be correct, classes separated in the theories of other authors, are put together in one class by Ajdukiewicz. However suppositions and judgments belong to two different categories, which is the reason why putting them in one class is a mistake. Assertion seems to be an essential feature of judgments. Everything that is devoid of this feature should not be considered as a judgment.

There is one more important reason for that. One shall say, that perceptual judgments are in reference to perceptual images. One shall also admit that secondary judgments are in reference to secondary images. However there is nothing that is in reference with recalled judgments, and probably that stems from a bizarre status of those judgments.



4.3. *Emotions*

4.3.1. *Sources of Feelings and Desires*

The prime source of feelings is a group of drives and impulses. *Impulses* are dispositions which are the condition of feelings and volitive states. Undoubtedly dispositions towards some feelings are innate. An example might be the feeling of distress caused by pain, which – for the majority of people – is unpleasant. Obviously we may also distinguish states, being a result of what we have learnt during our lifetime. The example of such a state might be the desire to go to the theatre. However, if we analyze such states more deeply, we will admit that they are still the result of some innate dispositions (impulses). And so there are three types of impulses:

(a) Individual impulses – they evoke all the desires that cause a human being to take up only those actions which bring any beneficial effect for them.
(b) Generic impulses – they evoke desires that cause a human being to take up actions beneficial not only for them, but also for the whole species (*i.e.* the sexual drive).
(c) Social impulses – they evoke desires that cause a human being to take up actions beneficial for the whole social group to which they belong (creating groups).

4.3.2. *Distress and Pleasure*

It may be stated beyond any doubt that feelings built on presentations and judgments usually impose motifs on our actions. That is mainly because some elements of distress and pleasure strongly influence the way we perceive the world and particular states of affairs. They appear in the area of our consciousness as the aftermath of various situations that take place in our lives. There are surely various types of pleasure and distress. Distress may appear *i.e.* in the case of breaking one's arm or in the case of listening to an ugly melody. It seems that distress and pleasure do not appear in isolation, but are elements of more complex states. Even if we analyze pleasure after savoring a tasty dish, we must admit that it appears in the realm of the sensations, such as: taste, smell, sight and touch. Taking into consideration what was mentioned above, we may claim that events do not evoke pleasure and distress directly. Events may cause impressions, convictions, presentations, and by means of those states they do evoke pleasure and distress in an indirect way. Mental states which directly evoke pleasure and distress might be called the psychological basis of pleasure and distress. Pleasure and distress themselves, as described by Ajdukiewicz, should be perceived as an emotional tone. Thus an emotion is a whole composed of a psychological basis and an emotional tone.

4.3.3. *Classification of Emotions*

According to Ajdukiewicz there are three types of feelings: pleasant, unpleasant and mixed. Types of feelings are dependent on what the composition of a particular feeling is. Let us analyze some examples. Say, happiness. The essential part of happiness is pleasure, therefore it is a pleasant feeling If we think about anxiety, there is no pleasure in the content, but distress. So the feeling is unpleasant. If there is a mixture of pleasant and unpleasant components in an emotion, we can say that a feeling is mixed. The example might be longing for something. On one hand longing is unpleasant because of an absence of a beloved person or desired object, on the other hand it is pleasant because of the dream of future meeting with that person, or havening a desired object. Philosophers sometimes understand mixed feelings as two feelings directed towards one object in two temporal moments. For example when we admire a work of art, at the very beginning it may fill us with disgust, but after a few moments we may start to like the painting. Ajdukiewicz, however, seems to understand mixed feelings in a different way. According to this philosopher, mixed feelings are composed of two contradictory feelings directed towards two different objects in one temporal moment. The example might be longing mentioned

above. Taking into consideration the complexity of human mental life, it seems that the majority of feelings are mixed.

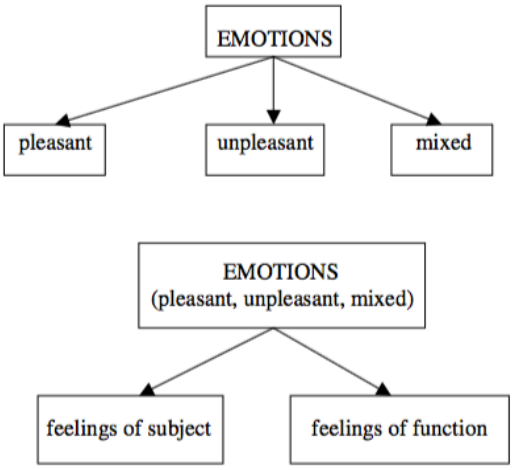
Not only are emotional tone and the type of psychological basis important elements of emotions, but also the physical reaction of the body seems to be essential. For instance when one is frightened, one's body starts to numb, one cannot breathe and one feels a characteristic sinking feeling in the stomach. It perfectly shows how big the influence of feelings on our body is. Feelings which are extremely strong and have a really strong influence on our body are mental strains (*i.e.* angriness, fear, despair, euphoria). While being under mental strain it is hard to think reasonably and logically.

Ajdukiewicz mentions also another classification of feelings. This classification is based on the type of an object of feelings. The object of a feeling may be identical with the object of a psychological basis or it may be totally different. Therefore we may differentiate between feelings of object and feelings of function. Let us analyze those two classes. In the case of feelings of object, the object of psychological bases gains some kind of emotional tone and because of that we start to perceive this object as emotionally pleasant or unpleasant. An example might be a situation when we perceive somebody's face. If this face is connected with something unpleasant that happened to us, we perceive that face as disguising. Not only is the face the object of psychological bases (perception), but also the object of the feeling.

When taking into consideration feelings of function, the situation is slightly different. Let us ponder over pleasure being a result of solving mathematical exercises. The objects of psychological bases (perception and thinking) are figures printed on a piece of paper. Nevertheless the pleasure is the result of the act of solving the task, not figures printed on the piece of paper. In this case we cannot say that an object of feeling is identical with an object of psychological bases. The great example of these kinds of feelings are moods.

Undoubtedly feelings are strongly related to desires. Desires might be positive – as happens when we want some situation to take place, and negative—if we want something to disappear, like in the case of hunger. Objects of desires are either possible to achieve or impossible to achieve. Desires are essential elements of many feelings, like in the case of hope. When one hopes that x will happen, one believes that x will happen but at the same time one desires x. Another example might be despair. Not only does desire appear in this feeling, but also conviction about the impossibility of achieving one's goal. Last but not least – in case of disappointment – when the action of fulfilling our desire did not bring us the expected joy.

The bedrock of desires is made up of emotions. In order to desire an object, one must have an emotional attitude towards this object. The object of desire is not a feeling of pleasure or distress connected with making our desires true, but something that may evoke an emotional tone in us. It remains, however, beyond any consideration, that if there is a desire, there is also an emotional reference to an object and an effort of trying to make the desired goal real. There are two types of desires: passionate desires (if we are strongly concerned about fulfilling our wish) and reserved desires (its value is not shown to us in emotion). The example of a reserved desire is a resignation from something pleasant (*i.e.* eating fast food) in order to stay in good health. Resignation does not evoke any strong feelings, and the object of one's desire is health.



4.4. *Acts of Will*

Acts of will might be divided into passive (improper) and spontaneous (proper). Passive acts of will are somehow imposed on a human being. They cannot be perceived as independent acts of human beings. An example might be a situation where I am hungry and I want to eat something. The wish to eat something is imposed on me because of the physiology of my body and not because of a conscious and independent decision to eat something. Proper acts of will remain one's independent wishes, and the starting point is one's conscious self. An example might be the sentence: I want to go to the cinema today. Passive wishes might (but do not have to)

be connected with disapproval, whereas spontaneous wishes are always positive. Let us take into consideration a situation where I want to smoke a cigarette. I am aware of the fact that it is bad for my health, so I try to destroy this wish in me. I disapprove of it. When it comes to proper acts of will, approval is one of the essential elements of those states. They are always connected with the feeling of being right. Perceiving the action as right is necessary to take it as our own, and not as imposed. Acts of will do not necessarily have to stay in contradiction to passive wishes. Sometimes they go in the same direction. If I am thirsty, I perceive my wish to drink something as something passive. Nevertheless I may sympathize with it and perceive it as my own, and then drinking something will become the goal of a spontaneous wish. Ajdukiewicz does not give an answer to the question of whether all acts of will have their basis in passive wishes.

A great example of passive wishes are moods. I may say: I want to cry. It means that I am probably in a bad mood. My mood is to some extent imposed on me. Some philosophers, however, claim that moods are rather feelings, and the case that brings confusion is description. If we say: I am sad, instead of: I want to cry, then it stays beyond any doubts that this mood is a feeling, not a state of will. It can be said thus, that semantic and syntactical structures form (in a way) the character of moods.

Acts of will often lead to decisions and resolutions, and those are the basis for actions. Resolution – according to Ajdukiewicz – is an act of will that leads to the accomplishment of a goal by one's own action due to having the conviction that one will accomplish the goal by one's own action.

Except for resolutions, we may specify intended actions (or intentions) as being obviously one of the classes composing proper acts of will. Intention is a conditional decision about an action. I may say, for instance, "I am going on vacation," and probably I intend to do so, but only in certain circumstances, like good weather or taking leave at work *etc*.

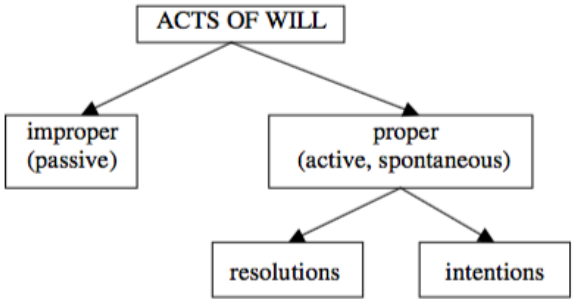
Taking into consideration what was mentioned above, we may differentiate among the following structures:

(1) If *a*, then *b* (intended action).
(2) I will do *b* (resolution).

The difference between resolutions and intended actions is quite bizarre. In fact each time when I make a decision I presume some conditions necessary for realizing that decision. They do not have to be uttered in a sentence expressing the decision, but if the conditions are not satisfied, the resolution will be broken or changed. If I make the decision: "After work I will go to the airport and buy a ticket to London," at the same time I create in my mind additional assumptions about conditions that must be fulfilled in order to make my decision real. Those are, for example: "If I don't have

to stay longer at work," "If I don't get sick suddenly," "If the airport is not destroyed" *etc*. It seems that sentences expressing resolutions and intentions are always these kinds of structures, even though the conditions are not always present in an utterance.

Acts of will are expressed in the form of sentences about the future. We cannot say, however, that every sentence about the future is an act of will. Sentences expressing judgments about one's future action are resolutions only if one issues them on the basis of a particular act of will. Resolutions are not always fulfilled. The change of a resolution means nothing but withdrawing and replacing it with another resolution that is often contradictory to the initial one. We break a resolution if we strongly prefer to fulfill goals that are in opposition to the goals of our initial resolution. One may also break a resolution if conditions for fulfilling it are not sufficient, so that fulfillment is simply impossible, even though one expected something else.



5. Classification of Thoughts in View of Categorical Grammar

Ajdukiewicz believed in a strong coherence between language and thought which was the result of his extraordinary and original theory of categorial grammar, distinctly different than generative grammar which had been at the forefront previously. That led to a classification of thoughts that had never been created by anyone else. Ajdukiewicz believed that by analyzing the structure of an utterance, it is possible to comprehend the structure of thought.

In that case, let us answer the question of how this specific isomorphism of language and thought is possible? First of all, the essential condition for something to be uttered is the presence of thought. Each thought possesses a specific property that makes it possible to create a syntactic structure of

that thought. It moreover enables the utterance to adapt to other utterances. As a result, the property is common for all thoughts, which make up coherent whole. We call this property a syntactic property of thought. It is the property that «decides» about the characteristics of an utterance and, at the same time, is the principle of classification, which means that on only the basis of this property, one may distinguish between various thoughts and semantic categories of utterances. Two utterances belong to the same semantic category if and only if they are associated with one syntactic property of a thought. The first division of thoughts entangled in utterances was created by Ajdukiewicz in the form of a dichotomy of active and passive thoughts. Whether the thought is active or passive depends on the behavior of a thought in the utterance. Let us take into consideration the following sentence: "John likes Peter." It seems to be obvious that the word "likes" functions in the sentence as active – it unites other elements of the sentence into a coherent whole. Elements which are united by an active thought are passive and at the same time primary elements of that sentence. All the active elements of the sentence, Ajdukiewicz (as well as Kotarbiński) calls determiners. Passive elements, on the other hand, do not influence other elements of an utterance and are called arguments. Determiners can never be names, but they can create names, sentences or other determiners. And so, according to an idea expressed by Ajdukiewicz in unpublished *Wykłady z semantyki logicznej* [*Lectures on Logical Semantics*], delivered in Lvov University in 1930/1931, it can be said that a thought imposes form on sentences and other expressions. If a passive thought appears in one's mind, we utter a name. However if an active though appears in our mind, we utter a determiner. Therefore thoughts are the initial elements of language and remain its basis. Furthermore it has to be stated that the aforementioned division is universal, as it appears in every language.

According to Ajdukiewicz, every semantic category refers to a particular class of mental acts. If we take into consideration determiners, we should say that those which create names (noun phrases; *e.g.* "a beautiful picture"), express active thoughts connected with presentations; whereas those which create sentences, express active thoughts connected with judgments.

Passive thoughts can be described in a similar way. Presentations are passive thoughts (arguments) expressed by names. Judgments are articulated by means of positive statements, which are possible to consider as true or false. When it comes to judgments, however, the problem is not so easy to solve as it seems to be at the very beginning. According to Ajdukiewicz some judgments may be easily uttered in the form of positive sentences. Yet some of them are impossible to utter by means of language. Therefore we may divide judgments into those which are possible to articulate and

those which are impossible to articulate. The most common example of a judgment impossible to utter is when one tries to solve a mathematical task and suddenly finds a solution. At the very beginning, however, the idea is so vague, that it is impossible to utter. Only after some time, is it possible to express it. Another example is when one passes the road and sees a vehicle coming. According to Ajdukiewicz, it is impossible to express this situation in the form of a sentence. There is a doubt arising from such an understanding of judgments impossible to utter. If it is so hard to express the view of the vehicle coming, how is that possible that other trials of description of our reality may be perceived by Ajdukiewicz as appropriate? Maybe our language is such an imperfect tool that all the descriptions that we consider as appropriate and adequate are only the illusion we want to believe in, just in order to live in a false conviction of having the power to create sciences and harness nature? I leave that issue open as it is not the aim of this paper to solve this problem. Yet taking into consideration the characteristics of judgments impossible to articulate, I do not think it gives us a sufficient picture of such judgments.

Ajdukiewicz divides judgments possible to articulate into verbal and non-verbal. When it comes to non-verbal judgments, Ajdukiewicz does not provide us with any characteristics. Nevertheless he gives us the characteristics of verbal judgments. They are expressed by means of speech (silent or loud) and are composed of a presentation and a moment of assertion, either positive or negative. The moment of assertion may have various degrees of intensity. In some of the verbal judgments we cannot find the moment of assertion – those judgments are counterparts of suppositions specified some years earlier by Twardowski.

Another type of thoughts are those expressed by means of interrogative sentences. It can be said that those thoughts are quite similar to desires or acts of will. Their classification is somehow similar to that of judgments. When expressing interrogative sentences one experiences a kind of psychological tension connected with a desire to gain a conviction about something, but not identical to that desire. The one who asks does not think about their future knowledge about the subject of a question but about that subject itself. That state is a kind of interest compounded with psychological tension. Thoughts expressed by means of interrogatives might be divided into questions seriously asked and those which are only the subject of thought. When it comes to questions seriously asked, we really care about the matter we ask about; unlike in the case of thoughts which are only the subject of thought. If someone asks “Where is my umbrella?” we do not want to fill an epistemic gap, as the case of the umbrella is indifferent to us. We do not really feel the need to get knowledge about something. We only concentrate on comprehending the question. Therefore that thought is

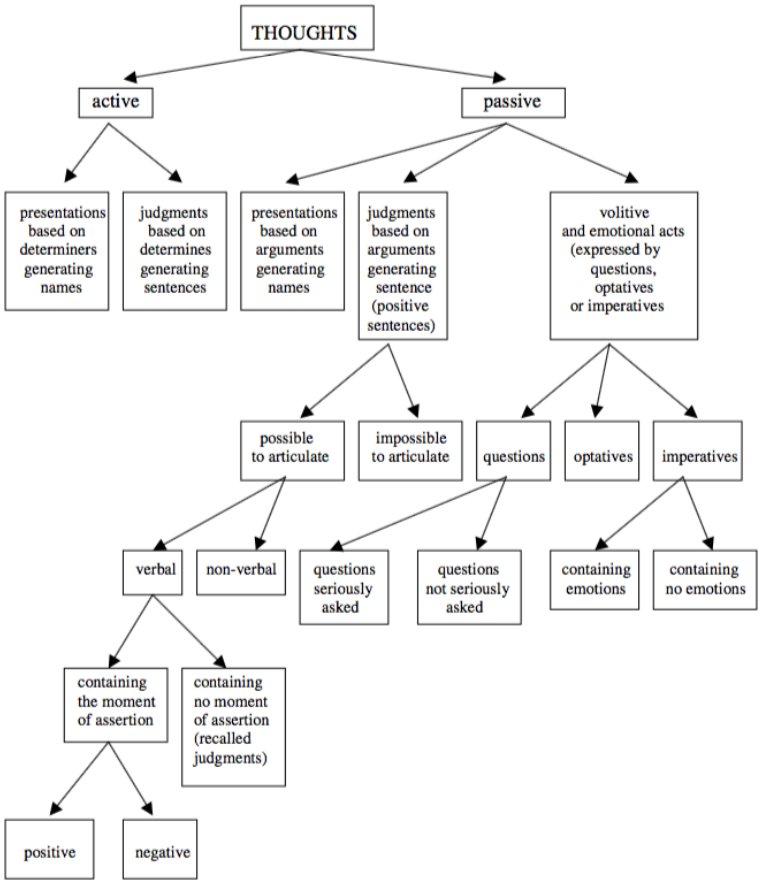
not the question seriously asked. A kind of doubt arises here. In his definition, Ajdukiewicz considers every question as referring to feelings. But if it is possible to ask questions and be indifferent to the answer, it means that not every question refers to feelings – those are never indifferent. We could agree on such a definition only under the condition of treating indifference as a kind of feeling. That issue of indifference is not solved by Ajdukiewicz.

Another unresolved issue is a type of thought expressed by imperative sentences and optative sentences. One may suspect that thoughts articulated by means of optatives are a certain mixture of feelings and will, mainly hope, desire and wishing. If we say: "May the doctor cure John," we express a kind of sadness caused by the fact that John is ill, a hope that the doctor will cure him and a wish that the doctor will really do that. The situation will not be the same, however, in the case of every imperative sentence. Only some of them truly express the aforementioned mixture (for example when a mother says to her son: "Don't be lazy!" – she expresses her angriness and wish that the situation will change). Yet an imperative sentence does not have to express emotions, as in the example of a general, saying to his solders: "Present arms!" That is not connected with emotions (in the majority of situations) but with a wish to make the imperative come true. In conclusion, we may say that when one thinks about language, it is hard to mark a vivid border between utterances expressing emotions and volitive states. It shows that both types of states are strongly associated with one another and in some cases interdependent and coexisting.

6. Conclusion

It is beyond doubt that the heritage of Ajdukiewicz concerning the classification of mental acts is very valuable not only from the philosophical but also the psychological point of view and that it poses a brilliant foundation for further investigations. Ajdukiewicz gives us a wide view of how our mental life should be classified and provides us with a unique idea of classification based on categorial grammar.

What has to be stated is that both classifications, the one based on the traditional approach and the one based on categorial grammar, provide us with two separate divisions. One of the major differences between them is how volitive states and emotions are classified. In the classification based on the traditional approach, emotions and volitive states pose two separate classes, whereas in the classification based on categorial grammar, they are placed in one class.



Even though there are some issues that are not fully solved, Ajdukiewicz shows us the way that the classification should be created and leaves room to elaborate on the area of mental life. Further investigations on that issue should probably pay more attention to language describing mental processes which may enable us to understand human beings better.

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Jacek Jadacki

JAKUB KARPIŃSKI IN THE ORBIT OF THE LVOV-WARSAW SCHOOL

In the Library of the Faculty of Philosophy and Sociology of Warsaw University there is a copy of an article entitled "The Postulate of the Operativity of Definitions in Social Sciences" with the following inscription by the 22-year-old author: "Let me dedicate this work to Professor Kazimierz Ajdukiewicz – Jakub Karpiński." In the book *Przyczynowość w badaniach socjologicznych* [*Causality in Sociological Research*], Karpiński refers to Ajdukiewicz's description of the difference between an experiment and an observation (1985, p. 73); many mentions on Ajdukiewicz's views can be found also in other works.[1] Karpiński's texts also contain references to other members of the Lvov-Warsaw School, including its founder, Twardowski (1992[1978], pp. 8, 18).

From this point of view, stating that Karpiński's academic output revolved around the tradition of the Lvov-Warsaw School is justified, even in the eyes of those readers of his work who do not know that Karpiński was simply Ajdukiewicz's disciple.

Still, I wish to put forward a bolder proposition: his output did not only revolved around the tradition but also grew from it and developed it. To quote Karpiński's words, Karpiński "reviewed" this tradition, "indicating some of its concealed assumptions, in order to […] further build on it" (1992[1977], p. 30).[2]

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[1] See for instance (Karpiński 1964).

[2] An example of such creative development, of Ajdukiewicz's erotetics in this case, is the draft of the theory of questions included in *Wprowadzenie do metodologii nauk społecznych* [*Introduction to the Methodology of Social Sciences*] (1980, pp. 136 *ff.*; also see 1965, pp. 36–37). In this case, the development consists in, *e.g.*, adding the typology of completive questions (questions about descriptions, questions about values of variables, questions about

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This is not a new idea. It was clearly formulated ten years ago, and recently repeated, by Professor Sułek (2003; 2013). However, I shall attempt to supplement it with my own, and thus: new, justification, and simultaneously present Karpiński's general methodological views, as he was too preoccupied with his political activity to do such work. It will be merely an inventory, incomplete, simplified, and, let us add, ahistorical, as Karpiński would put it, since we cannot allow ourselves to produce a satisfactory systematization, a neat arrangement, which they surely deserve.

An additional incentive for me to work on this matter is Karpiński's relationship to semiotics, which I deal with. Here is what he wrote about it:

> Analysis of culture uses concepts and statements created in the general theory of a sign: in semiotics. One of the basic functions of a sign discussed in semiotics is its reference to reality, called "the semiotic function" […]. Attempts to determine specific features of science refer to its semiotic character, among other things (1977c, p. 29).

> The semiotic approach to culture […] assumes that the properties of products of culture (symbolic culture) lead to conclusions about what is not a given product of culture. Works belonging to symbolic culture are considered as signs (often fairly complex), and a sign usually informs about something which is not itself (1992[1978], p. 9).

1. Ontological Tolerance

A specific feature of the Lvov-Warsaw School was ontological tolerance. Assuming a given ontology is not a matter of philosophical «to be or not to be» for members of the School, but rather, it is a matter of theoretical «necessity».

Karpiński's attitude towards ontological questions was the same. For him, a directing question for ontological analyses is not "What, and perhaps how, EXISTS?" but rather "What, and perhaps how, MUST BE DEEMED AS EXISTING, in view of the requirements of science?".

In the brilliant *Wprowadzenie do metodologii nauk społecznych* [*Introduction to the Methodology of Social Sciences*], written in a communist prison, as we learn from Professor Sułek (2013), Karpiński indicates two basic ontological assumptions which scientists usually assume «irreflexively». The first one is "the claim about the existence of the world," and thus, the claim that "utterances formulated within the scope of science

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scope and questions about relationships between features) and the notion of the proper answer in the broader sense to Ajdukiewicz's concept.

refer to something besides science" (1980, p. 12). The second one is a claim which specifies "the way in which objects of research of science exist" (1980, p. 12). It is worth noting that the second assumption is «named» by Karpiński, but he does not directly state what the assumption claims: *i.e.* that the objects of the research of science exist in a given way.

This is not accidental. The matter is that scientists differ in the way of determining the manner of the existence of objects they research. There are two main ontological "tendencies": monist and pluralist. Karpiński describes them in the handbook, but does not clearly favor any of them, even though he indirectly rejects monism when he writes:

> One may […] do science and research mythology or examine the reality presented in literary works as a scientist. One does not then have to identify the manner of existence of the researched objects with the manner of existence of elements of the real world. One may state that these researched objects exist only intentionally […]. Someone who examines products of culture deals with objects which exist intentionally and states the features of these objects (1985, p. 105).

On the other hand, in non-didactic texts Karpiński firmly advocates for ontological pluralism. In his opinion, there are many realities: there is the world of things and people; there is the world of events in which objects take part, as well as actions performed by people, including their experiences; there is also the world of culture (artifacts). The latter is not in any meaningful way reduced to the two former, although it is dependent on them to a certain degree: its source is in the world of human actions and experiences, and the basis of its existence is in the world of things and people (1992[1978]; 1992[1975], p. 44). One could say that the world of culture is created by people only to a certain degree; an important part of it (for example, that which includes at least some regularities) is also discovered. We should add that the world of culture cannot exist without some media, which are parts of the world of people and objects, but is not dependent on any specific media in its existence (1992[1975]).

Karpiński does justice to two Polish philosophers who, in his assessment, formulated similar thoughts in a satisfactory and innovative manner: Chwistek and Ingarden. The former was the creator of the modern form of pluralism, which he named "the theory of the multiplicity of realities" (Chwistek 1921), and he attempted to characterize it in a way which would satisfy the 20th-century standards of precision. The latter, having deemed the world of culture a field of purely intentional objects, subtly analyzed this field, and especially literary work (Ingarden 1931) as well as its relationships with the remaining fields of reality. This is how Karpiński comments on it:

> Ingarden created an in-depth and complex theory […] [of the world of culture], mostly referring to those parts of it which are in the field of interest of aesthetics. […] It is not easy to determine the character of the relationships between […] [artifacts and psycho-physical activities which are their source]; one would have to analyze more closely the basis and course of registering the content of culture with the help of material objects, as well as reading this content from the properties of the objects. These and similar problems were noted by Ingarden or even solved (1992[1975], p. 25).[3]

By favoring ontological pluralism, Karpiński rejects both reistic monism and the idealistic interpretation of the world of culture. At the same time, he speaks against idealism within the scope of the theory of law, which ascribes timeless and spaceless character to norms, in an original way:

> If someone assumes the ideal existence of law but does not identify this ideally existing law with the law available to experience, then it is hard to protest against such actions while still remaining grounded in science, and on the other hand, assuming such an existence of law has little influence over what occurs in science, as it refers to experience itself (at least insofar as it is an empirical science) (1992[1975], p. 45).

This could be called "an argument from theoretical neutrality"; besides, a similar kind of argumentation is directed at monism, primarily at reistic and psychologistic monism (1992[1975], pp. 46 *ff.*).

2. Causal Relationships

Two further assumptions accepted in science, according to Karpiński, are the following: the assumption of the recurrence of events and the assumption of their coexistence, which can be combined into the claim of determinism. It is supported by, *i.a.*, the fact that people make correct predictions (1980, p. 75).

A specific kind of coexistence is coexistence based on a causal relationship. Karpiński has a good reason to call such a coexistence "conditioning" (1965, p. 41). He devoted a separate monograph, *Przyczynowość w badaniach socjologicznych* [*Causality in Sociological Research*] (1985) to the analysis of this relationship, within the scope of the field researched in sociology.[4]

According to Karpiński (1985, p. 93), there are three necessary conditions for *A* to be the cause of *B*:

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[3] In a weaker version of this assessment, Karpiński states that "there are strong arguments" in favor of allowing artifacts (especially literary works) "the status of *sui generis* reality, for instance, intentional creations" (1992[1977], p. 69).

[4] See also (Karpiński 1977b).

(1) *A* and *B* are events;
(2) *A* is the condition of *B*;
(3) *A* is not-subsequent to *B*.

The "event" mentioned in point (1) may be understood as either a change in a certain object in a certain aspect in a certain time (that is, in a moment or a longer period), or a state of affairs which persists for a time (1985, p. 8). In the first understanding, the lack of occurrence of the so-called encumbering conditions cannot be considered as a cause.

Describing the cause in the categories of a condition, and thus, identifying the causal relationship with conditioning is a reference to the trend of thought initiated in the Lvov-Warsaw School with the classic dissertation by Łukasiewicz, "Analiza i konstrukcja pojęcia przyczyny" ["An Analysis and Construction of the Notion of Cause"] (1906).

The condition with which a cause is identified in point (2) may either be an arbitrary, sufficient or necessary condition (which is when causal law is non-exceptional), a conductive condition (then causal law has exceptions) or a necessary (essential) component of a sufficient condition. In the case of a cause understood as a conductive condition, we can only state that *A* is the cause of *B* in the degree *S*, where *A* is the conductive condition of *B*, when *B* occurs with *A* more often that without *A* and this is not a false relationship (1985, p. 15). As for causes identified with the necessary component of a sufficient condition, if all sufficient conditions have one and the same component, it is simply a necessary condition; on the other hand, it is not the case when there are sufficient conditions with different necessary components for all of them.

In view of the condition of non-subsequence of the cause in relation to the effect formulated in point (3), Karpiński presents a moderate standpoint. He writes:

> Perhaps […] the claim of one-way character of causal effects is an analytical claim (1985, p. 95).

Karpiński notes that sometimes conditions (1)–(3) are supplemented with another condition:

(4) *A* affects *B*.

In view of this condition, he follows Ingarden (1985, pp. 94–95) in stating the following objection:

> It is sometimes said that the cause affects the effect. However, it is not always easy to explain how an event may affect another event which has not begun yet (affect without necessarily causing it) (1985, p. 14).

This is why he himself does not accept condition (4). In my opinion, as Ingarden would say, it is a premature resignation. Assumption (4), according to which, affecting is 'tied' into a causal relation, which makes it "dynamic," seems most correct. It is enough to reformulate it accordingly so that it does not have any indicated paradoxical consequences. If I could discuss the matter with Karpiński, I would suggest that causal situations should be determined with the help of formulas of the following structure:

(ZP) The fact that a given *x* affects a given *y* is the cause of a certain state (a certain change, in particular) of this *y*.

The set of events remains the field of relationship of causality, but according to the formula of the type (ZP), it is not the cause which affects the effect but the fact that a given object is affected by something is the cause of the fact that this object changes in a specific manner (or, more generally, is in a certain state).

I would also present to Karpiński, an objection to the characteristics of a process as "the course of events in time" or "a temporal arrangement of events" between which "causal relationships occur" proposed by him (1985, pp. 48, 49). This characteristic contains a categorical mistake: a PROCESS is neither a COURSE nor an ARRANGEMENT of given events, but rather a SERIES (or more generally, a set) of specifically arranged and interconnected events.

Karpiński deems "peculiarities of causal analyses in social sciences" (1985, p. 19) to be the fact that condition (1) is not limited to changes (1985, p. 20), and that condition (4) is very rarely assumed at all; especially in sociology, this causal relationship is very rarely treated as a dynamic relationship, that is, as conveying energy or information to the effect by the cause. Therefore we could say that since "the relationship of causal conditioning is considered […] as a relationship occurring between features or between variables" (1985, p. 20), then the relationship itself may simply be identified with the co-occurrence of these features or variables (respectively, sets of features). Karpiński's general statement on decisions pertaining to terminology may be quoted here, as it well describes his attitude in this respect:

> Perhaps it would be right to use the word "cause" in a more restrictive manner. Yet, it seemed appropriate to review the meanings and situations in which we speak of causes before making the decision to restrict the meaning of the term. Above we used a broader concept of conditioning and distinguished various kinds of it. Realizing this variety may be useful, regardless of how one decides to interpret a causal relationship. Besides, similar distinctions may constitute the basis of relatively rational decision making processes on terminology (1985, p. 20).

Let us also note that the concept of cause reconstructed above is a concept which may be called "an observational concept." Karpiński mentions the so-called operational (respectively, manipulative, or experimental) concept of cause (1985, pp. 72, 98, 100), according to which:

(PE) *A* is the cause of *B* when *B* occurs after intentional (conscious) induction of *A* by experimenter *E*.

3. The Valuation of the Theory

It would seem that the problem is clear: a given theory is good, always and only, when it is true – or at least when it "aims at truth." History of science shows however that it is a double idealizations: neither "always," nor "only."

Karpiński wrote:

> It has long been thought that science aims at truth. However, it has also long been noted that, firstly, this criterion is not entirely clear and should be fixed; and secondly, that this criterion is not used invariably (in all stages of conduct), and thirdly, even if the criterion is used, it is not the only one (1992[1977], p. 94).

The notion of truth as a regulatory idea is not used "in the usual sense," *e.g.* in deductive sciences; apart from it, the criteria of "economy, informational value, or explanatory power" are used (1992[1977], p. 94). Moreover, the criterion of veracity is not used to evaluate methods; the latter are evaluated according to the cost of their application, "understood as all kinds of losses," *e.g.* "the destruction or damage to the object of research" (1992 [1977], p. 95). It is a kind of a moral criterion. Its presence is especially visible in sociology:

> A characteristic feature of […] [social] sciences is […] evaluating the publication of the results according to the potential influence of the published information directly on the researched persons (1992[1977], p. 99).

Łukasiewicz wrote in a quite similar vein, albeit in a different context, about veracity and the manner of justification of logical truth, in his dissertation *O zasadzie sprzeczności u Arystotelesa* [*On Aristotle's Principle of Contradiction*] (1910).

Karpiński added, modifying (and in this case, radicalizing) the views expressed by Łukasiewicz in his article "O twórczości w nauce" ["On Creativity in Science"] (1912):

> In science we do not aim at the truth about everything. In any case, we do not aim at having knowledge about everything available to everyone (1992[1977], p. 98).

On the other hand, Karpiński's careful phrasing on the influence of the conceptual apparatus on the view of the world echoes Ajdukiewicz's conventionalism:

> Not everyone […] believes that the choice of the language of description is insignificant in science, or that it is a decision whose only justification is convenience, the usefulness of the assumed solutions in the realization of certain objectives within or without science (1992[1978], p. 5).

4. Operationalization of Definition

In the ending of a short text "O jasnym i niejasnym stylu filozoficznym" ["On Clear and Unclear Philosophical Style"], one of the canonical texts of the Lvov-Warsaw School, its founder wrote:

> An author who cannot express his thoughts clearly also cannot think clearly, […] therefore his thoughts do not deserve any attempts to be decoded (Twardowski 1919, p. 348).

Karpiński strongly believed that the lack of clarity of language, criticized by Twardowski here, is one of the sources of "useless banter" (1962, p. 141) in science. One of them, the pseudo-controversy between operationism and anti-operationism (1962, p. 135) was closely analyzed by him in order to isolate real problems concealed in it under layers of verbal misunderstandings, and which the "evolution" of the terms of operationism indicates (1962, p. 136).

The main problem here is the question of the criteria which a procedure of defining in science should fulfill. Karpiński begins with a very liberal definition of a definition. He writes:

> The word "definition" shall be understood very generally here, as any verbal determination of the meaning of a term (1962, p. 140).

At some point definitions in science began to be expected to fulfill the postulate of operationism. The history of the operationism *versus* anti-operationism debate is, according to Karpiński, a history of "the gradual liberalization of the postulate of the operationism of definitions" (1962, p. 41).

Let us assume as our point of departure the following definition of "operational definitions" quoted by Karpiński:

> Operational definitions are such definitions which include a description of verifying operations and certain results of these operations (1962, p. 139).

An operational definition of the term '*T*' therefore has the following general outline[5]:

(DO_1) If *x* undergoes operation *X*, then (*x* is *T* when *x* will be *Y*).

The property denoted by '*Y*' is observable, and its occurrence is the result of operation *X*.

By reconstructing the postulate of the operativity of definitions, Karpiński refers to Przełęcki (1959) and supplements his proposition of specification (and schematization) of this postulate. He indicates that:

> Operativity is not a sufficient condition for [scientific] correctness of concepts. In order for concepts to be correct, they must fulfill two necessary conditions: (1) [concepts] must have theoretical significance […]; (2) defining operations must be dependable.
>
> Moreover, it is preferable when these concepts fulfill the following conductive conditions: (3) when they are ordering, (4) when their definitions provide important features, (5) when they are accurate; and finally, just as importantly, (6) when […] they are used [and] (7) when their definitions are reporting (1962, p. 147).

In consequence, various methods of verification determine different concepts.

Karpiński proposes to "terminologically differentiate," (1962, p. 150) as he puts it, operational definitions and operative definitions:

> Operative definitions are […] definitions which provide descriptions of observable states of affairs. […] The postulate of defining terms through providing descriptions of observable states of affairs leaves for operationism whatever is rational in it, that is, the readiness to provide an empirical character of scientific terminology; on the other hand, it removes the main drawback of the first stage of this doctrine, namely, denying scientific value to concepts whose definitions are not equipped with descriptions of verifying operations (1962, p. 150).

Therefore, it can be stated, again in a simplified form, that it is ultimately postulated that definitions of the term '*T*' have the following scheme:

(DO_1) *x* is *T*, when *x* is *Y*.

Naturally, '*Y*' is an observational term in (DO_1). This postulate can probably be identified with the postulate of the diagnostic character of definitions (1985, p. 145). Diagnosticity interpreted in this way provides intersubjective communicability and intersubjective controllability of scientific claims to scientific terminology.

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[5] To be more precise, it is one of possible schemes. This scheme can be weakened by adding an implication rather than equivalence in the consequent, and by preceding the consequent with the auxiliary "most probably," *etc*.

For the purposes of psychological and sociological practice, Karpiński expands the postulate of operational defining scientific terms to include the so-called indicators (in particular, indicators which he calls "definitional indicators," as opposed to dependency indicators), that is, properties of the type α which are indicators of the property β based on the fact that possessing the property β was defined through possessing properties of the type α:

> The postulate of the operativity of the definitional indicator of a given property is synonymous with the postulate of the operativity of a definition of a given PROPERTY (1962, p. 152).

It is worth noting that Karpiński does not only write about operational definitions but also constructs a certain general theory of definition which, incidentally, is the source of certain difficulties.

First of all, he contrasts semantic definitions with nominal definitions. Semantic definitions are supposed to express assigning: the proper denotation to a given term (1985, p. 100); nominal definitions introduce the defined expressions into the language, "leaving aside semantic relationships" (1985, p. 103). An example of the former is the formulation: The term "social classes" signifies big groups of people which differ from each other in relationship to the means of production. An example of the latter is the formulation: Instead of saying "a situation in which an individual holds at least two convictions such that accepting one of them substantiates the rejection of the other one," we can say "cognitive dissonance." Karpiński is not alone in overlooking the fact that the latter definition (and any other nominal definition) can easily be transformed into an equivalent semantic definition by stating, *e.g.*: The term "a cognitive dissonance" signifies a situation where an individual holds at least two convictions such that accepting one of them substantiates the rejection of the other one – and because of this paraphrase the sentence "Cognitive dissonance is a situation where an individual holds at least two convictions such that accepting one of them substantiates the rejection of the other one" will also be an analytical thesis.

Secondly, Karpiński maintains the traditionally distinguished type of real definitions, that is, definitions which provide "an unambiguous characteristic" of a given object (1985, p. 143).

A closer analysis indicates that the differences between the so-called semantic, nominal and real definitions can ultimately be reduced to differences of modes of expression.[6]

[6] This is at least true for identity definitions; equivalent definitions (with equivalence in the function of a definitional connector) obviously do not have an identity paraphrase for purely syntactic reasons.

5. Methodological Schemes

The main methodological postulates of the Lvov-Warsaw School are considered to be the postulate of clarity of language mentioned before and the postulate of sufficient justification of the held, and especially, proclaimed, views. These two postulates may be expressed in short: the greatest possible precision and the best possible argumentation. Still, there is a third postulate: the postulate of correct classification.

Karpiński referred to the latter postulate when he lamented the "low degree" of specification of individual research methods used in sociology, so that "they are far from being algorithms," but also because of "strange rules" (or actually, the lack of explicit rules) for classifications of the researched fields of objects done by sociologists (1976, p. 57). A striking example of this latter methodological fault is what passes as classification of methods used in sociological research: it often occurs that traditionally distinguished kinds of research methods are the effect of a cross between several simpler, «single-rule» classifications.

In place of traditional, methodologically faulty, classifications of sociological methods ("schemes"), Karpiński proposes the following typology[7]:

(a) structural research – where not only objects of a given group in isolation are taken into consideration, but also the relationships between them;

[7] Let us add that Karpiński's propositions do not exhaust the typological variety achievable through using all possible combination possibilities. Such a supplementation of Karpiński's analysis would be a pleasant and useful task to do for those who would like to continue his work. It would be best if it was done in his style, a beautiful example of which is the range of typology of social structures proposed by him (1992[1977], pp. 27 *ff.*), and another example of which, *in extenso*, is provided below (see the introductory characteristic of the comparative method). Such a supplementation would require making a certain «qualitative» correction of Karpiński's proposition. For instance, specific phases of a discussed group, examined diachronically, may be treated as two different groups examined comparatively; with this interpretation, diachronic research is a sub-type of research of acomparative kind. Another example, which is also mentioned by Karpiński on one occasion (1976, pp. 66): instead of examining the relationships between members of a given group as individuals, one could examine the relationships between them as elements of specific sub-classes of that group. Besides, a decision would have to be made as to what actually the method here is; following Karpiński's remarks on schools in science, structural, comparative and diachronic research was not isolated because of the applied research method, but rather because of the object of research (the properties of the elements in a given group, the relationships between the elements of that group, the relationships between two groups, *etc*.). From this point of view, experimental research, certainly distinguished in the manner it is conducted in, would not be "both" comparative and diachronic, as Karpiński postulates. The only issue is that the experimental method is used in both kinds of research.

(b) comparative research – where not one but at least two different groups with separate matrices of data are examined, but which have at least one «common» column of variables (indicators);
(c) diachronic research (including panel research) – where for one group, or more precisely, for different temporal phases of this group, there is more than one matrix of data (with the same, or similar, or completely different columns of indicators);
(d) experimental research – where apart from observation of the examined group an experiment is conducted, and therefore, the parameter of "the researcher's influence on the group" (1976, p. 63) must be taken into consideration.[8]

Let us perhaps add that Karpiński is prone to interpreting the matrices of data mentioned before, constructed by a sociologist, in the categories of responses to completive questions in Ajdukiewicz's understanding.

The kind of research analyzed in the most detail by Karpiński, in a separate work (1977a), is comparative research. The initial fragment of this work is perhaps worth quoting as a telling example of Karpiński's scientific prose:

> In a very broad sense, "comparative research" is what can be […] called research where at least two objects are examined in at least one aspect. In research of this kind, various relationships between objects may be examined: difference and equality in a given aspect, but also being greater or smaller, and differences and relationships (quotients of dimensions) of objects in a given aspect (depending on whether the variable in view of which the objects are examined is a classifying, ordering, additive or quotient variable). In all these cases, objects are compared, and the comparison leads to determining their difference or similarity, being greater or smaller, or the size of the difference and the relationship between the objects. The result of comparative research interpreted thusly can be classification of objects based on their comparison. Conversely, in order to make a classification, we need a comparison (and possibly a measurement) of the objects.
>
> "Comparative research" in the narrower meaning is what can be called research where at least two groups are examined (instead of any two objects), and where both the features of elements of this group and the features of this group are examined. In this interpretation, comparative research is many-leveled in the sense that it concerns both the group and its elements (1977a, p. 536).

In the course of the discussion of methodological schemes, Karpiński compared the notion of scheme with the notions of paradigm and idealization. It is an interesting issue, although its interpretation by Karpiński

[8] Karpiński also discusses survey research as a separate type. Yet, the methodological status of such research is unclear, especially its relationship to empirical research. The same is true for the so-called analysis of content in the sociology of literature (1992[1977], pp. 77 *ff.*), which examines "social references" of the properties of literary works (1992[1977], p. 81).

poses several objections. The methodological scheme is, as it was demonstrated, a kind of a method used to research a specific field of objects. A paradigm is, as it seems, a «substantive» theory (usually reductionist), accepted as current in a given time in this field although, let us admit, a paradigm may also consist of the obligation to use a specific methodological scheme. We could say that idealization is a procedure which replaces the researched reality with abstracted "model situations" (1992[1977], p. 79; see 1985, pp. 89, 91). This is exactly what justifies the statement that "in science, […] non-existing phenomena are also examined" (1992[1978], p. 89). However, this special kind of a methodological scheme is not valued by Karpiński. Still, his main objection does not sound very convincing: it is that in sociology, as well as other related disciplines, and as opposed to physics and related disciplines, "it is still hard to control the correctness of approximations to reality" (1976, p. 69), which may result in the loss of semantic function by the idealizing theory.

6. Identification of Schools

At the beginning of Karpiński's very promising career, the famous work by Ossowski, *O osobliwościach nauk społecznych* [*On the Peculiarities of Social Sciences*] (1962) was published. One of the chapters was entitled "Standpoints and schools." This is what Karpiński referred to when he sought substantive criteria for identification of schools in science.

He drew from an earlier tradition of the Lvov-Warsaw School, that is, to the distinction between actions and the products of these actions, introduced by Twardowski and subsequently commonly accepted (Twardowski 1912). When we speak about science, we must strictly observe this distinction. Science as science-creating activity is different from science as the product of this activity. A sociologist may be interested in either of them.

Let us begin with functional understanding of science. This is what Karpiński writes about science in this aspect:

> Science is a collective activity consisting in acquiring, preserving and processing information (1977c, p. 28). Scientific activity may be treated as a set of actions. The choice of the field of research and the choice of terminology are preliminary actions. They are followed by formulation of problems (possibly in the form of questions), choice of methods and formulation of claims (1977c, p. 32). If we decide to treat doing science as explorative activity, then repeating claims should probably be counted as didactics rather than science understood as creative work (1977c, p. 33). The choice of a specific kind of researched field, terminology, questions, claims, methods or explanations restricts freedom within science. […] Schools in science may be subject to methodological dogmatism (1977c, p. 35).

Let us add a third element to the couple: activities-products, that is, subjects of these activities, and it becomes clear why Karpiński warns against calling the sociology of scientists as subjects of science-creating actions "sociology of science" understood as the sociology of products of actions undertaken by scientists (1992[1978], p. 6).

Schools in science, which became objects of interest for Karpiński, were usually distinguished as schools in science interpreted functionally. Thus, they were simply certain specific social groups. Their identity, just as in the case of the identity of any society, was determined by internal connections (energetic and especially informational), the degree of organization and the feeling of belonging (either consciously declared or being a derivative of ascribing such belonging by people from the outside).

However, Karpiński sought more than just purely sociological criteria, that is, substantive criteria. What distinguishes science understood as creation from other spheres of culture is having, or at least postulating, a semantic reference; art is on the other side of the spectrum in this respect. This is why a substantive criterion (in Karpiński's sense) of distinguishing scientific schools (trends) is, either conscious or unconscious, choice of given factors of reference. In particular, this is the choice of:

(a) the scope of research (the issue is about "which fragment of reality is chosen for examination" (1977c, p. 30)): *e.g.* observable or non-observable objects, historically or non-historically distinguished, that is, with respect of similarity);
(b) the language for description of the field of research;
(c) the manner of examination of that field (*e.g.* introspection, understanding);
(d) research questions;
(g) the set of established statements;
(f) the manner of substantiating statements;
(g) a kind of desired explanations (*e.g.* one-factor or many-factor);
(h) the manner of creating a theory (*e.g.* sticking to or departing from experience, applying or not applying mathematics);
(i) an extra-scientific program which leads the research (*e.g.* meta-scientific or ideological).

Karpiński was fully aware that specific positions on the list have complicated correlations. In particular, *e.g.*:

> It is sometimes difficult to determine whether […] [in the case of distinguishing schools of science], the examined problems are connected with the choice of the field of research or the choice of terminology (1977c, p. 30).

Various choices pertaining to points (a)–(i) are the subject of disputes between schools as well as between representatives of various schools. Karpiński thoroughly reviewed the kinds of the disputes. What is more, he constructed an outline of the theory of the disputes in science which has not since become obsolete. According to Karpiński:

> [Disputes are] situations in which someone claims something, for instance, thesis *R*, and communicates the conviction that if *R* then not *T*, and the conviction that someone else claims or could claim the thesis *T* (1965, pp. 31–32).

Theses *R* and *T* described in such manner are called contentious theses. In other words, contentious theses are theses which are mutually exclusive (that is, they cannot both be true at the same time). There is nothing… contentious in such an interpretation of contentious THESES. However, what is original is the interpretation of a contentious SITUATION proposed by Karpiński. It is usually thought that such a situation should include two characters: two «sides» which are in dispute. Let them be opponents *A* and *B*. Therefore, we have:

(1) A claims that p.
(2) B claims that q.
(3) $p \Rightarrow$ not-q.

Yet, Karpiński believes that in order for a dispute to occur one "active side" is sufficient. The idea is that the case is as follows:

(1′) A claims that p.
(2′) A claims that *B* claims that q.
(3′) A claims that ($p \Rightarrow$ not-q).

In this interpretation, Karpiński can easily introduce the notion of pointless dispute, when *A* is mistaken in claiming what is claimed in (2).

One may assume one of the following positions towards contentious theses:

(a) not accept either;
(b) accept one and dismiss the other;
(c) accept both.

If attitudes (a)–(c) are legitimate, then in the case of (a) we are dealing with an irresolvable dispute, and in the case of (b) and (c) we are dealing with a resolution of the dispute. In the last case, we must accept the dispute as only apparent, that is, agree that the so-called contentious theses do not in fact preclude each other. This is the case not only when 'p' and 'q' are sentences which do not fulfill condition (3), but also when at least one of them is not a sentence in the logical sense at all (1965, p. 46). According to

Karpiński, non-utilitarian evaluations are of this character. He wrote firmly about such evaluations:

> A (non-utilitarian) evaluation can usually be treated as an expression of approval (or disapproval) for the occurrence of a phenomenon; the dispute over whether the approval is correct is not resolvable. Sometimes we express our approval directly, by using the predicate "good" or "bad," but in science formulations of the type: "It is good that this and this occurs" are extremely rare. If we evaluate phenomena in a scientific work, if we assume an evaluating attitude towards them, we probably do it without the mentioned predicates and make use of much greater possibilities of extra-cognitive functions of language as well as of more diverse impressive and expressive functions of utterances (1965, p. 44).

***

Finally, let us present a general impression of a reader who knows the work of the Lvov-Warsaw School fairly well. The simplicity of Karpiński's style is striking. He even formulated… a simple directive in this matter:

> In order to speak of something, it is good to simplify the matter somewhat, at least at the beginning (1992[1977], p. 29).

Since "the propensity of the human mind to simplify phenomena […] facilitates their understanding" (1976, p. 70), the simplicity of Karpiński's works is paired with their clarity. What Karpiński ascribed to Tatarkiewicz's works: "clarity, accuracy and explicitness" (1992, p. 106), was also fulfilled by him to a high degree. There is a… simple test to prove it: it is hard to summarize his statements (just as in the case of Tatarkiewicz), in the sense of an original account of what he wrote, rather than what about. This is the result of following the rule which Karpiński himself, according to Professor Sułek (2013), put in the simple words, "The shorter the better."

The fulfillment of these ideals entails sticking to a specific path, as professor Sułek would put it, namely the path initiated by Twardowski: the path, the direction of which was later determined by his most eminent disciples: Łukasiewicz[9] and Ajdukiewicz[10] (and to a much lesser degree, let

[9] Karpiński took over from Łukasiewicz *i.e.* the theory of reasoning.

[10] What Karpiński took over directly from Ajdukiewicz was a large part of the ontological and logical conceptual scheme, *i.e.,* the concepts of the state of affairs and an occurrence; the concept of language and, more generally, semantic concepts; the concept of measurement, experiment and observation; the concept of a theory; the concept of a question and an answer, *etc*.

us add, *e.g.* Kotarbiński, who followed the roadside more often than not, or even strayed from the path altogether).[1]

Jakub Karpiński followed this path, the path of the Lvov-Warsaw School, in science.

We may only regret that it was for such limited time.

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[1] Let us note that Kotarbiński's flagship ontological «invention»: reism (or somatism), was met with Karpiński's critique: harsh in content but gallant in phrasing (1992[1978], pp. 6 *ff.*; 1992[1975], pp. 46 *ff.*).

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CONCLUSION

Jacek Jadacki

TRADITION OF THE LVOV-WARSAW SCHOOL IN THE SECOND HALF OF THE 20TH CENTURY IN POLAND[1]

1. Logic

1.1. *Sentential Calculus*

Sentential calculus, which had been an object of investigation under Łukasiewicz's leadership at the Warsaw school in the period of prosperity, in the following years continued to be studied mainly by logicians assembled around Słupecki and Borkowski. Outside the group were Gumański (1981), who constructed equivalence (reversible) systems, and Pietruszczak (1991), who was occupied with quantifierless calculi. Grzegorz Malinowski (1990) developed Chrisippian (two-valued), as well as non-Chrisippian (many-valued) logic initiated by Łukasiewicz, including three-valued logic. Zawirski's suggestions as to the possibility of using it in physics were taken up by Kiczuk (1995). But new ideas appeared as well.

Firstly, Łukasiewicz's questioning of Chrisippos' principle of bivalence was followed by Suszko, who rejected Frege's principle of identity of denotation of sentences with their truth-value. Thus, the next non-classical logic – after the non-Chrisippian one – came into being: namely, a non-Fregean logic, which assumes that denotations of sentences are identical to corresponding situations. Omyła (1986) systematized this new logic.

[1] The article is a result of the project "The Significance of the Lvov-Warsaw School in European Culture," supported by the Foundation for Polish Science.

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Secondly, systems of nihilistic logic were constructed (Żabski 1995). They were founded upon a conception of truth according to which a sentence of the form "The sentence *p* is true" is synonymous with the very sentence *p*; such systems can be used to solve some antinomies. The genesis of research on «paradoxical» logics was analogous; they allowed for a substitution of sentential variables with nonsensical (or sense-losing) expressions (Piróg-Rzepecka 1966; 1977; Piróg-Rzepecka and Morawiec 1985).

Thirdly, studies in logic which result from the weakening of classical logic by the elimination of some axioms (or rules of inference, respectively) were undertaken. Special attention, inspired by Jaśkowski (1948), was devoted to intuitionistic logic, which rejects the principle *tertium non datur* and which was already an object of Zawirski's interest, as well as to para-consistent logic, allowing for – or rather ignoring – contradiction by removing Duns Scotus' law from among the axioms (Paśniczek 1984; 1988).

1.2. *Nominal Calculus*

All three versions of nominal calculus considered by Twardowski's immediate students were pursued. Słupecki (1955), Iwanicki (1965) and Kwiatkowski (1980) worked on an adequate interpretation of Aristotle's syllogistic, Nieznański proposed for it his own axiomatization (1966) and Iwanuś (1969) discussed – in contrast to Łukasiewicz's standpoint – the possibility of enriching it by introducing names denoting empty and full sets. In the area of functional calculus, codified by Borkowski (1958–1960), interesting results were obtained due to the generalization of the notion of quantifiers – by taking into account ramified quantifiers and by the construction of systems containing such «bifurcational» quantifiers (Krynicki, Mostowski and Szczerba 1995). Extending functional calculus (of the first order) to «fictional» (Meinongian) logic – pendant to the above mentioned enrichment of syllogistic – made by Paśniczek (1998) is even more interesting. Leśniewski's ontology also continued to be an object of interest (Słupecki 1955; Lejewski 1958; Iwanuś 1969; 1973; Borkowski 1991). Elementary nominal calculi, close to ontology, were built by Kubiński (1971b), while Rogalski (1995) adjusted ontology to the needs of the reconstruction of medieval metaphysics.

1.3. *Erotetics*

The genesis of modern erotetics in Poland can be found in Twardowski's incidental remarks and in Ajdukiewicz's theory of questions developing these remarks. Their ideas were taken up and completed by Giedymin (1964), Kubiński (1971a) and Koj and Wiśniewski (1989), as well as by

Leszko (1980), who used the theory of graphs and matrices for that purpose.[2]

1.4. *Mereology*

Attempts at completing Leśniewski's mereology have not ceased. The system of mereology was developed first of all by Sobociński (1954–1955; 1971a; 1971b). Lately, Pietruszczak (1996) has studied it intensively and Gorzka (1999) – on Tarski's inspiration – has extended it (by introducing the notion of the diameter of a region) with a view to constructing an ontology without points.

At the same time, attempts at constructing an alternative mereology have started, using the notion of founding (Rosiak 1995; 1966).

1.5. *Metalogic*

Metalogical research went in two directions.

The first (meta-mathematical) direction, determined by Tarski, contained a generalization of his theory of deductive systems (Słupecki and Bryll 1975; Rasiowa and Sikorski 1963; Rasiowa 1968) and the theory of proof (consequence), in particular (Borkowski 1970; Zygmunt 1984).

The second direction, initiated by Hosiasson-Lindenbaumowa, aimed at a satisfactory reconstruction of the logic of induction (Mortimer 1982).

1.6. *Semantics*

The model-theoretical semantics initiated by Tarski turned out to be the dominant semantics in Poland. Pelc (1971) contrasted with it functional semantics – and, broadly, semiotics – as more suitable for the analysis of natural language. Starting from a similar motivation, Wybraniec-Skardowska (1985) chose categorial semantics (she constructed an original axiomatization for it), while Pogonowski (1993) declared for combinatorial semantics. Moreover, specific semantics for languages of many-valued logics were examined (Lechniak 1999).

Among particular semantic problems, the main attention was paid to the problem of empty, ambiguous and quotational subject terms as well as to sel-referring expressions, probably because of their antinomiogeneity. After Kotarbiński, semantic functions of empty names were discussed by Dąmbska (1948a) and Gumański (1960) as well as by logicians interested

[2] The detailed presentation of Polish logicians' contribution to the theory of question is given by Brożek (2007b). She is also the author of two large monographs concerning erotetics (2007a) and the theory of imperatives (2012).

in systems that allowed empty names in their vocabulary (Iwanuś 1976; Wybraniec-Skardowska and Chuchro 1991). The problem of ambiguous names was analyzed by Kubiński (1958), by Przełęcki (1964), who extended it to the problem of undetermined expressions and interpreted in model-theoretical semantics, and by Muszyński (1988); recently, Odrowąż-Sypniewska has published a detailed monograph concerning this subject (2000). Kubiński (1965) tried to find a remedy for difficulties concerning the usage of quotational names, indicated already by Leśniewski and Tarski. Self-referring expressions were examined by Koj (1967) and Stanosz (1973).

On self-evident grounds, semantic antinomies and paradoxes, which played such an important role in the logical research carried out by Twardowski's students, also attracted a lot of interest. Among people who came back to them were: Suszko (1957b), focusing on the liar antinomy (in Łukasiewicz's formulation); Koj (1963), linking semantic antinomies with the problem of transparency; Stanosz (1965), analyzing the paradox of intensionality.

1.7. *Pragmatics*

Two pragmatic relations were the main object of examination: asserting and understanding. The stimulus for examining the former came from Ajdukiewicz and for examining the latter from Dąmbska.

Detailed reviews and systematizations of the problems of assertion were written by Majdański (1974) and Patryas (1987). Koj (1969) and Kmita (1971) analyzed the nature and criteria of understanding (within the framework of the theory of interpretation). A systematic survey of the conceptions of understanding was made by Jadacki (1990a).

2. Ontology

In ontology as practiced in Poland in the past fifty years, two (actually complementary) tendencies competed with one another: in the last ten years they have been emphatically articulated as Perzanowski's formal ontology program (ontologic) (1988) and as Placek's experimental ontology program (or metaphysics in general) (1995). Both programs referred to Augustynek's ontological program, the program of experimental ontology being (consciously or not) a radicalization of Augustynek's postulate requiring that an ontological system be adequate to modern physics (1970).

2.1. *Theory of Being or Existence*

In the domain of the theory of being, two thematic spheres dominated: the analysis of the notion of existence and the program of unifying (the picture of) reality.

It was Twardowski, Leśniewski and Ajdukiewicz who initiated, in Poland, the modern analysis of the notion of existence and non-existence. Then, the subject was taken up by Gumański (1960), who formulated it in terms of existential assumptions, Kubiński (1985a), Czarnocka (1986), who examined the nature and criteria of existence in the natural sciences, and Przełęcki (1979; 1980), who, in discussion with Jadacki (1980), focused on the ways to eliminate problems connected with sentences about non-being.

The program of unifying reality took either the form of argumentation in favor of the structural unity of the world (Tempczyk 1978; 1981) or the form of the realization of the postulate of onto-categorial reduction.

As far as reduction of ontic categories is concerned, the Lvov-Warsaw School entered into the second half of the 20th century with Kotarbiński's reism seriously impaired by Borowski's and Ajdukiewicz's criticism. This criticism was continued by Wolniewicz (1990), Przełęcki (1984) and Szaniawski (1977), who indicated the unlikeliness of a satisfactory interpretation of the distributive notion of a set in this system. However, reism also had its defenders (Czerniawski 1997). In the meantime, competitive conceptions have appeared. In those conceptions categories other than things were accepted as basic categories, namely: properties (attributivism), states of affairs/facts (situationism), events (eventism) and processes (processualism). Żabski gave a formal shape to attributivism (1988) and Leszek Nowak developed the idea of a negative ontology opposed to (positivistic) attributivism (1998–2007). Situationism was elaborated by Wolniewicz (1968a; 1985) and Omyła (1996). These attempts were accompanied by an analysis of the notion of a state of affairs covering negative (Kowalski, Krzysztofiak and Bilat 1998) and intentional (fictional) states of affairs (Pelc 1983; Paśniczek (ed.) 1991; Paśniczek 1998). The most perfect shape was given to eventism, considered by its author, Augustynek (Augustynek and Jadacki 1993), as an ontology adequate to relativistic physics. Processualism had its adherent in Tempczyk (1986).

The structural basis for these new reductive formal ontologies – and most certainly of eventism – is set theory. A quite different – namely combinatory – character was given by Perzanowski to his refined ontological systems.

2.2. *Theory of Necessity and Possibility*

The analysis of necessity and possibility has been carried out almost exclusively within the range of modal logic (see below).

2.3. *Theory of Time and Space*

Augustynek has undertaken detailed studies on time – referring to Leśniewski's and Kotarbiński's polemics, Ajdukiewicz's conception and Zawirski's and Dąmbska's considerations concerning the logical status of sentences about the future. Firstly, he proposed a definition of time (1970) compatible with relativistic physics; secondly, he analyzed various properties of time (topological and symmetric, in particular) (1970; 1975); thirdly, he introduced relational notions of the past, the present and the future (1979). Snihur (1990) was his opponent regarding this last issue.

Perzanowski's analyses concerning space (within the framework of a more capacious system of locative ontology) (1993) are equal to Augustynek's analyses of time.

2.4. *Theory of Change and Motion*

A theory of change should resolve two difficulties: how to overcome paradoxes of motion and becoming and how to reconcile changes with the identities of changing objects. Regarding the first matter, Ajdukiewicz (1948a) proved that it is possible to describe change without infringing on the principle of non-contradiction or the principle of the excluded middle. In this matter, Placek's subtle analyses (1989; 1995) turned out to be decisive.

Regarding the second matter, Czeżowski wrote a short paper (1951b), while Augustynek gave it more attention, proposing his own definition of gen-identity (1981).

2.5. *Theory of Determination and Causality*

The notions of determination and causality, and determinism and causalism, respectively, so absorbing for Łukasiewicz and (later on) for Kotarbińska, were reconstructed precisely by Mazierski (1961), Augustynek (1962), Zbigniew Jordan (1963) and Trzęsicki (1989).

3. Epistemology – Methodology – Praxiology

During the last fifty years traditional epistemology has not been cultivated, in principle, in the Lvov-Warsaw School. It was Ajdukiewicz's standpoint which was decisive here: according to him, epistemological problems

could be studied only after a suitable semantic paraphrase and after such a paraphrase they became indistinguishable from respective methodological problems. However, some people saw the necessity of distinguishing epistemology from methodology (Zamiara 1974). On the other hand, methodology itself could be recognized either as a fragment of praxiology, constructed in the second half of our century, or – on the ground of some assumptions – as a fragment of a theory of behavior (Malewski 1964), or, finally, as a fragment of the theory of artificial intelligence (Lubański 1975) and the cognitive sciences (Bobryk 1988).

In the youngest generation there is a tendency to return to the traditional problems of epistemology in their original form, but with modern methods, *e.g.*, the realism-idealism controversy (Krysztofiak 1999).

3.1. *Programs*

In Polish philosophy of the last half century, four main (usually competing) methodological programs have functioned: apragmatical and pragmatical, on the one side, and descriptive and normative, on the other. Moreover, they have been realized either by means of semantic analysis or by means of formal reconstruction.

A clear differentiation between the first two programs – referring to the general distinction between acts and results made by Twardowski – appeared thanks to Ajdukiewicz (1948b). Thus, it was realized that (apragmatical) meta-science should be carefully separated from psychology and the sociology of cognition. The sociology of cognition – with some elements of historiosophy – became an object of greater interest only in the last phase of the twentieth-century Polish philosophy (Pietruska-Madej 1980; Jodkowski 1990; Jonkisz 1990; 1998).

In this trend they analyzed, in general, such matters as the question of continuity (paradigms) and changeability (revolutions) in science. The meta-scientific attitude was dominant. Psychologico-sociological analyses provoked, at once, serious objections from the «apragmatists» (Kałuszyńska 1994b).

Apart from apragmatical or pragmatical interest, methodologists were divided in respect to the descriptive and normative approaches. Some of them (Leszek Nowak 1971; 1973; Kmita 1976; Giedymin 1982; Sady 1990) wanted to restrict themselves to the logical reconstruction of real procedures used by scholars to obtain these results. Others (Koj 1998; Teresa Hołówka 1998) thought that their main task was formulating indications determining the methodological duties of scientists.

All of these programs were criticized by Misiek (1979).

3.2. *Knowledge-Creative Procedures*

Within both the pragmatical and apragmatical programs the knowledge-creative-procedures and their results were objects of detailed examination.

Firstly, analyses concerned observation, more generally, evidence (Rojszczak 1994), and especially experience (Kalinowski 1991; Czarnocka 1992) and measurement (Kałuszyńska 1983). Measurement was subjected to penetrating considerations by Ajdukiewicz (in the final period of his life) (1961). In the School a broad understanding of empirical cognition dominated which included not only introspection, but also axiological intuition (Czeżowski 1949; 1960a; Przełęcki 1996). Problems of observation were formulated, in general, in terms of observational sentences; in such a context, the problem of the analytical components of factual sentences corresponded to the problem of theorized facts (Jodkowski 1983). It was usually connected with the problem of the status of theoretical terms (Borkowski 1966; Przełęcki 1969; 1993; Nowaczyk 1985; 1990; Kałuszyńska 1994a). Żytkow (1979) identifies those terms with sets of operational procedures.

Secondly, studies in inferential procedures (ways of reasoning), begun already by Twardowski and Łukasiewicz, were creatively continued. Polish philosophers analyzed both infallible (deductive) and fallible (inductive) inferences. Regarding infallible inferences, problems of mathematical proof (Słupecki and Pogorzelski 1962) and its algorithmisation (Orłowska 1973; Zwinogrodzki 1976; Rasiowa, Banachowski *et al*. 1977; Marciszewski and Murawski 1995), on the one hand, and problems of verification (Czeżowski 1951a), on the other hand, were worked upon. Ajdukiewicz (1958) began the studies on the problem of the logical reconstruction of fallible inferences; Mortimer (1982) took it up in its full generality and Orłowska and Pawlak (1984) interpreted this kind of reasoning as inferences in systems with incomplete information. Other philosophers examined particular fragments of the logic of induction: the theory of inference by analogy (Dąmbska 1962) and the possibility of its mechanization (Zwinogrodzki 1982); the theory of «historical» inferences (*i.e.* inferences on the basis of testimony) and the question of the reliability of informants (Giedymin 1961); finally, the theory of probabilistic (Czeżowski 1952) and statistical inferences, in light of which it appeared that the majority of the fallible methods of inference have no degree of infallibility (Szaniawski 1994). A separate study was devoted to the notion of certitude (Sady 1993).

Problems of deduction were seen, more and more commonly, as problems of justification; moreover deductive justification was opposed to deductive inference (Borkowski 1966). Analogously, induction was linked with the context of discovery, which was logically reconstructed in the spirit of the School (Zamecki 1988; Pietruska-Madej 1990; Sady 1990).

Prognostics (Woleński 1984) and explanation, as well as the notions of scientific law (Pelc, Przełęcki and Szaniawski 1957; Mazierski 1993) and hypothesis (Herbut 1978) respectively, were engaging a good deal of attention.

Thirdly, procedures of formulating problems were not neglected. The theory of questions took the shape of erotetic logic. Among particular matters, the notion of the essence of a problem was at the center of investigations.

Fourthly, mereology and set theory were used to describe procedures of partition, classification and ordering. In particular, a theory of classification was developed by Czeżowski (1950) and Batóg and Łuszczewska-Romahnowa (1965), to whom we owe its generalization.

Fifthly, Polish philosophers gave a considerable amount of thought to the verbalization and interpretation of theories. Twardowski's followers have always remembered his postulate of clarity and, even if they did not officially accept its theoretical foundation, arguing that sometimes a clear thought cannot be expressed clearly (Gorzka 1990), they have in practice struggled to observe this postulate to the highest degree. In this area, studies culminated in the analysis of definition, inaugurated in Poland in the modern manner by Leśniewski and Ajdukiewicz. Afterwards, many people were occupied with the theory of definition: Kokoszyńska-Lutmanowa (1971; 1973) (who declared for the solution which assumes only one notion of definition, contrary to Ajdukiewicz), Borkowski (1966), Gregorowicz (1962), Stonert (1959) (in deductive sciences) and Pawłowski (1978) (in humanities).

3.3. *Rationality*

In the domain of epistemologico-methodological problems, the main subjects of inquiry were definition, typology and criteria of rationality. Dąmbska's pre-war research on irrationalism constituted a background for later attempts to get to grips with this question. Direct or indirect links connected her research with Grzegorczyk (1993; 1997), who finds in rationality a distinctive feature of European civilization; with Przełęcki (1996), who enlarges the notion of rationality beyond the limits of scientific knowledge; with Marciszewski (1991), who concentrates his considerations mainly on the rationality of discussion; with Życiński (1993), who struggles to indicate the place of rationality within the compass of religion; and finally, with Grobler (1993), who analyzes especially the notion of deferred rationality.

Apart from these considerations, rationality has been approached in decision theory (Szaniawski 1994).

Finally, Kleszcz (1998) presented a review of the results of examinations in this area, distinguishing seven types of rationality (conceptual, logical, ontological, epistemological, methodological, practical and axiological); he contrasted the rationality of convictions with the rationality of acts; described the difference between rationality, on the one hand, and irrationality or non-rationality, on the other; drew up a list of criteria for rationality, introducing into it: verbal precision, application of logical laws, criticism and resolvability of entertained problems. Strawiński also added simplicity to them and devoted a special study (1991) to it.

3.4. *The Problem of Truth*

The problem of truth has not stopped being a mater of penetrating inquiries since Twardowski presented a persuasive criticism of alethic relativism and Tarski developed the semantic (model-theoretical) version of the correspondence conception of truth. Nobody in this environment – especially after Kokoszyńska's additional explications – questioned alethic absolutism. Ajdukiewicz quickly retracted his radical conventionalism. On the other hand, Dąmbska (1962; 1975) argued that radical conventionalism did not lead to alethic relativism because conventions do not have to be arbitrary. The acceptance of moderate conventionalism (Giedymin 1982; Siemianowski 1983; 1989) could be reconciled, *a fortiori*, with the absolutist conception of truth. Let us add that, in general, skepticism in this matter was not shared (Wiśniewski 1992).

Similarly, the opinion that the correspondence conception of truth is correct, dominated. It was pointed out that both the coherentist and pragmatic conceptions were inadequate. This was done by either referring to common sense (Chwedeńczuk 1984) or to philosophical interpretations of limitation theorems (Woleński 1993). On the other hand, Grzegorczyk (1997) explicitly proved the accuracy of the correspondence conception. This does not mean, however, that the explanative power of conceptions of truth competitive in relation to the semantic conception was not tested. Thus, a «non-Fregean» version of the correspondence conception was constructed where states of affairs stated by sentences are considered to be extra-linguistic counterparts of sentences. Such a version was recognized as the most adequate interpretation of the classical (Aristotelian) solution (Borkowski 1995; Nieznański 1984; Jadacki 1990b; Biłat 1994; 1995). Tomasz Jordan's attempts (1989) tended towards a similar direction – approaching the intuitions of natural languages.

On the other hand, Grobler (1993) – not without sympathy – presented a version of the pragmatic conception, namely the dynamic (approximative) version, in which the property of being true is replaced by the relation

of being-more-closely-to-the-truth-than. Jacek Malinowski (1995) studied the illocutionary version with efficiency as an equivalent of truth. Another version of the pragmatic conception, namely the consensual version, was reconstructed lately by Kijania-Placek (2000).

Żabski (1995) build an original logic for the nihilistic conception.

3.5. *Praxiology*

Although the problem of distinguishing and analyzing actions (versus products) was formulated by Twardowski, it was Kotarbiński (1956a; 1966b) who was the real creator of the theory of action — *i.e.* praxiology. Afterwards, Podgórecki (1962), Pszczołowski (1969) and Ziembiński (1972a) proposed important contributions and improved syntheses.

4. Philosophy of Science

4.1. *Classification of Sciences*

Twardowski performed a penetrating analysis of the traditional classifications of sciences: the classification into *a priori* sciences and *a posteriori* sciences, in particular. The most universal inquiries into the notion of science and the classification of scientific disciplines – from various points of view – were undertaken by Kamiński (1961).

4.2. *Philosophy of Mathematics, Physics, Chemistry and Biology*

In the philosophy of mathematics, Batóg (1996) and Murawski (1995; 1999) were active. In particular, the question of the philosophical significance of reverse mathematics held the attention of the latter. Now, two representatives of the younger generation have joined to them; they have examined in great depth the arguments on account of mathematical realism (Bigaj 1997; Wójtowicz 1999) and intuitionism (Placek 1999).

In the philosophy of physics, the question of the philosophical interpretation of relativistic physics, brought by Zawirski was continuously an issue (Czerniawski 1993).

Lastly, the theory of chaos – and its implications for general philosophy – has become an object of study (Tempczyk 1995; 1998). At the beginning of the second half of the 20th century, Mehlberg (1951) considered the controversy between idealism and realism in modern physics; and at the end of it, Jodkowski (1996) studied the controversy between evolutionism and creationism in modern biology.

Pietruska-Madej's attention (1975) turned to the philosophy of chemistry.

4.3. *Philosophy of the Humanities: Psychology and Sociology, Linguistics, Jurisprudence and History*

Among philosophers from the circle of the Lvov-Warsaw School, Bobryk (1988) occupied himself with the philosophical problems of psychology.

The most serious results in the philosophy of linguistics were achieved by the program of formalizing theoretical phonology, formulated and realized by Batóg (1967; 1995) and Pogonowski (1979; 1981). As a result, a reduction of the basic phonological categories was obtained (Batóg 1967).

Relatively many philosophers worked creatively in the philosophy of law (Gregorowicz 1962; Ziembiński 1963; 1966; Nowak 1971; 1973; Woleński 1972; 1980; 1999). For instance, the status of juristic definitions (Gregorowicz 1962), modes of justifying juristic norms (Ziembiński 1972b) and the relation between juristic and ethical norms (Ziembiński 1966) were investigated. Giedymin (1961; 1964), Nowak and Kmita (1968) and Zamiara (1989) pursued the methodology of history – and, broadly, the humanities – concentrating their efforts especially on reconstructing procedures of intepretation (Kmita 1971) and also explaining the status of theoretical terms in the theory of belles-lettres (Kmita 1967).

4.6. *Reductions and Holism*

The problem of integrating the sciences and the chances of reductionism in this field were investigated by Strawiński (1991; 1997) and Grobler (1993). Jedynak (1998) probed in detail the empiricist version of reductionism; she showed that it could not be fully realized because of the disharmony of its particular components.

Siemianowski (1988) indicated the consequences of radical empirism.

5. Axiology

5.1. *Description, Estimation and Norm*

It was Twardowski's Lvov lectures in ethics which proved the main impulse for inquiries in axiology (or, strictly speaking, ethics) among Polish philosophers influenced by the Lvov-Warsaw School. In these lectures, the founder of the School declared himself a cognitivist and axiologist regarding the question of the relations between description, estimation and norm.

This standpoint – mainly thanks to Znamierowski (1957a), Czeżowski (1960a; 1960b) and Ossowska (1947; 1963) – has become the dominant paradigm in this context.

Ethics – as Ossowska emphatically stated – could be a science and not just a set of moral norms, if it were a science of moral phenomena, providing their scientific description and containing metaethics (1970) as well as psychology and sociology of morality (1963). Within the framework of the last of these, Ossowska, herself, reconstructed two examples of an ethos present in Polish society: the chivalrous ethos (1973) and the middle-class ethos (1956).

5.2. *Ontic Status and the Universality of Values*

In the controversy regarding the ontic status of values, Twardowski – and the other representatives of the School after him, like Tatarkiewicz – took the objectivist position: some objects are good *per se* and not because somebody considers them as good (Przełęcki 1981). Constructing a formal theory of goodness became a goal; and it was Czeżowski (1960a) who gave its outline first.

Objectivism was joined, in principle, with absolutism. At the same time, the analysis of scepticism (Dąmbska 1948b) and relativism in relation to the question of the universality of values was engaging a good deal of attention. Lazari-Pawłowska (ed.) (1975), following the slogan of the School – *clara et distincta*, contrasted axiological relativism with methodological, situational and cultural relativisms; Jacek Hołówka presented a monograph on the problem (1981).

5.3. *Motivation and Respecting Norms*

In the controversy regarding the sources of approval of moral norms, Twardowski and his followers were adherents of autonomism: moral norms do not need external justification, in general, and religious justification, in particular. For that reason, systems of independent ethics were developed (Kotarbiński 1956a; 1966a); they assumed the shape of atheistic Christianity (Przełęcki 1989), *i.e. hic et nunc* Catholic ethics but without theistic theses. Usually, after Tatarkiewicz, autonomism was connected with intuitionism (Czeżowski 1949). According to axiologism, that is good which is commanded; and, what is good in individual situations is – in the intuitionists' opinion – simply «visible». Thus, it is not surprising that the «organ» of moral cognition, conscience, was analyzed in detail (Górnicka-Kalinowska 1992).

Twardowski was a rigorist as to respecting moral norms. None of his followers proclaimed (or respected) such a radical rigor and some

people (Kotarbiński 1966a; Lazari-Pawlowska 1992) tended rather to a «soft» utilitarianism, presenting, in particular, its praxiological version (Pszczołowski 1982). Anyway, philosophers referring to Twardowski's program of scientific ethics, offered deep analyses of the notion of responsibility and fault (Znamierowski 1957b), liberty (Lazari-Pawłowska 1992) and justice, including just distribution of goods (Szaniawski 1994).

5.4. *Ethical Systems*

Separating, following Twardowski and Ossowska, ethical standpoints from the science of moral phenomena – as science *ex definitione* – Polish philosophers working under the banner of the Lvov-Warsaw School tried to model their own «unscientific» ethical views into the shape of possible, rationally-constructed systems. Altruism, humanitarianism and perfectionism were stable fiducial points here.

It is necessary (according to altruism) to take care not only of our own welfare, but also – and maybe first of all (Przełęcki 1989) – of others' welfare. The dominant position was occupied by the ethics of favor towards others (Znamierowski 1957c), of good relations with others (Ossowska 1983) or at least of esteem in relation to others (Witwicki 1957). Fair life consists just of taking care of others' welfare (Kotarbiński 1966b). In connection with the altruistic attitude, semantic analyses of such notions as equality (Czeżowski 1958) and tolerance (Lazari-Pawłowska 1992) were written.

In the controversy between maximalism and minimalism the majority opinion was on the side of minimalism. Taking care of others' welfare should manifest itself, in particular, in trying to minimalize the pains that others experience. This was the position of humanitarianism (Lazari-Pawlowska 1992). As far as our own good is concerned, the perfectionistic-ascetic standpoint was dominant: we ought to perfect our virtues, but the number of perfected virtues – if the enterprise is to be successful - should be radically limited, to civic virtues in particular (Ossowska 1973; 1983). Hedonism was, in principle, only an object of theoretical interest.

Tatarkiewicz (1947) wrote a splendid analysis of the notion of happiness, separating the happiness of an ethical character from vital, psychological and dispositional happiness. One of the results of this analysis was a justification of the thesis that hedonistic happiness cannot be a rational aim of human activity.

5.5. *Aesthetics*

In aesthetics, studies were focused on the psychology of the creation and perception of art (Tatarkiewicz 1951; Wallis 1968). Pawłowski (1989)

initiated an inquiry into aesthetic values, trying also in this sphere to make use of Occam's razor.

6. Formalization and Axiomatization of Various Domains of Knowledge

According to the paradigm of the Lvov-Warsaw School – at least in the version which owes its shape to Łukasiewicz and Leśniewski – the final form of philosophical disciplines should be their logical reconstruction and presentation in a shape of axiomatized formal systems. In the second half of our century, Poles constructed a few important systems of such «regional» logics, mainly of an intensional character (Jacek Malinowski 1989).

6.1. *Natural Deduction*

As far as a fragment of methodology is concerned, such a system was presented in the interwar period by Jaśkowski as a system of natural deduction (suppositional logic). It was a realization of Łukasiewicz's postulate to reconstruct by logical means the real modes of reasoning used in mathematics. Afterwards, many philosophers worked on developing and perfecting this system: Iwanicki (1949), Słupecki and Borkowski (1963), Suszko (1965), Nieznański (1966) and lately Dudkiewicz (1988), who concentrated his efforts on using the method of semantic matrices.

6.2. *Deontic, Diachronic, Relevant,* «*Creational*» *and Doxastic* (*Epistemic*) *Logic*

Deontic logic was a regional logic for ethics and jurisprudence. It was developed by Kalinowski (1965; 1972; 1996), Gumański (1980; 1981), Ziemba (1969; 1983) and Świrydowicz (Ziemba and Świrydowicz 1988), and Woleński (1972).

With historical inquiries in mind, Suszko (1957a) built a system of diachronic logic.

In the domain of natural languages, Leśniewski's and Ajdukiewicz's ideas were developed; furthermore, they were put into the mature form of categorial grammars (Suszko 1958–1960; Stanosz and Nowaczyk 1976; Buszkowski 1989).

On the other hand, problems with using «normal» logic to examine natural languages – signalized by Tarski – resulted in the development of relevant logic (Tokarz 1993).

Praxiology «obtained» a «creational» logic, *i.e.* logic of action (efficiency) (Kubiński 1985b).

It was Łukasiewicz who set the framework for inquiries into the logic of convictions in Poland with his analysis of systems with functors of acceptance and rejection, written in connection with his reconstruction of Aristotle's logic. Łukasiewicz's works concerning the logic of rejection were continued by Wybraniec-Skardowska and Bryll (1969) as well as Słupecki, Bryll and Wybraniec-Skardowska (1971–1972). Marciszewski devoted a monograph to the general theory of convictions (1972).

6.3. *Modal, Temporal, Transformational and Causal Logic*

Polish philosophers were also interested in the logical reconstruction of ontologico-physical problems. Various modal systems for the notions of necessity and possibility were built (Jaśkowski 1951; Żarnecka-Biały 1973; Perzanowski 1989). A review of various attitudes towards problems of modality in logic and philosophy was elaborated (Żegleń 1990). Great efforts were made to construct a temporal, «transformational» logic which could help to avoid the problem of change which threatened the principle of non-contradiction. Using Łukasiewicz's, Zawirski's, Słupecki's and Łoś's ideas, Rogowski (1964), Kiczuk (1984; 1985) and Wajszczyk (1989; 1995) engaged in research in this domain. Wajszczyk proposed detailed systems both for dichotomous (being – non-being and *vice versa*) and continuous changes. In the case of causal logic, as in the case of modal and temporal logic, the impulse came from Łukasiewicz and Jaśkowski (1951); later philosophers from a younger generation (Kiczuk 1978; 1995) have joined them.

6.8. «*Theological*» *Logic*

The program of scientific philosophy, formulated by Twardowski, was later extended – by Łukasiewicz, Drewnowski, Bocheński and Salamucha – to cover also theology. The extension was undertaken against the opinions of, *e.g.*, Witwicki, who claimed that theological problems (and religion in general) belonged to an irrational sphere. Witwicki's view was endorsed by Kotarbiński (1956b), Chwedeńczuk (1997; 2000) and – it seems – by the majority of the Schools sympathizers. Nevertheless, the opposite view has never lacked defenders (Życiński 1985–1986; Bronk 1996).

The main efforts were put into the logical analysis of traditional justifications (proofs) of the basic theistic thesis of God's existence (Bocheński 1965; Nieznański 1979; 1980).

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I must stress that the above picture of the theoretical problems and results achieved by modern Polish philosophy that acknowledges its links with the Lvov-Warsaw tradition is necessarily of a sketchy character. One can hardly expect more than an introductory diagnosis, if one realizes that now, in Poland, there are *circa* one thousand active philosophers.

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