

Kazimierz Ajdukiewicz: The Cognitive Role of Language

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Abstract. Kazimierz Ajdukiewicz was an eminent representative of the Lvov-Warsaw School. His main interest was the cognitive role of language. His radical conventionalism intended to explain rapid and fundamental changes in science. He used the method of philosophical paraphrase to make traditional metaphysical questions decidable. Then he drew metaphysical conclusions from the so called “semantic epistemology” based – according to his programme – on semantics (which played an important role in his research) and formal logic. His categorical grammar aiming to formulate the general criteria of syntactic coherence was the first grammar based exclusively on the structural properties of expressions. He also undertook a number of methodological issues, both general and detailed. He was interested in the theory of definition, the theory of questions, the problem of rationality of fallible inferential methods, the foundation of sentences, classification of reasonings, of sciences and of axiomatic systems, and in the reconstruction and evaluation of scientific procedures.

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1. Life

Kazimierz Ajdukiewicz (1890 Tarnopol – 1963 Warsaw) was an eminent representative of the Lvov-Warsaw School. In Lvov, he studied philosophy, mathematics, and physics. He was a disciple (and later on, also a son-in-law) of the founder of the School, Twardowski, but also studied under other teachers, such as Łukasiewicz, Sierpiński, and Smoluchowski. After having obtained his PhD degree in 1912 (*On the Relation between the Apriorism of Space in Kant and the Question of the Genesis of the Representation of Space*), he deepened his studies in Göttingen, where

he had the opportunity to attend lectures by Husserl and Hilbert. During World War I, he served in the Austrian army, to which he was conscripted, and later, in 1920, during the Bolshevik War, as a volunteer in the Polish army. In 1921, he received his habilitation (*From the Methodology of Deductive Sciences*). In the interwar period, he was first a professor at the University of Warsaw, and then, since 1928, at the University of Lvov. He survived World War II in Lvov, involved in administrative work, clandestine teaching, and – in periods free of the German occupation – lectures in scientific institutes. After the war, he was a professor at the University of Adam Mickiewicz in Poznań (where in the years 1948-1952 he served as rector) and the University of Warsaw (since 1954). He served many functions related to the animation and organization of scientific life. He participated in national and international congresses, organizing some of them; he edited prestigious scientific journals ("Studia Philosophica" and "Studia Logica"), travelled abroad in connection with his scientific activities (Great Britain, Austria, USA), was an active member of the Polish Academy of Sciences and other scientific associations, and established and led the Department of Logic at the University of Warsaw. In 1962, the University of Clérmont-Ferrand awarded him an *honoris causa* doctorate. The University of Adam Mickiewicz in Poznań had a similar intention, which was not carried out because of the death of Ajdukiewicz. In the postwar period, Ajdukiewicz and Kotarbiński were the main representatives of the Lvov-Warsaw School in Poland. They continued the School tradition of practicing broadly conceived logic, which included semiotics and methodology, and of using it to resolve philosophical issues. Ajdukiewicz described himself as a philosopher and a logician (in that order). He initiated and coordinated many research themes and educated students who later continued this work. A strong personality, he was considered a great authority among his colleagues and students.

2. Main publications

The most important publication of Ajdukiewicz's papers is *Language and Cognition*, comprising a selection of his texts from the years 1920-1939 (Ajdukiewicz 1960a) and 1945-1963 (Ajdukiewicz 1965a). The essential texts from that publication have also been translated into English and published as *The Scientific World-Perspective and Other Essays, 1931-1963* (Ajdukiewicz 1978r). Results of the author's research in methodology were published posthumously as *Pragmatic Logic* (Ajdukiewicz 1974), conceived as a university textbook. His *Problems and Theories of Philosophy* (Ajdukiewicz 1973) remained the main philosophical textbook for several generations of Poles. Both have also been translated and published in English.

3. Scientific activity

3.1. Meaning-rule conception and radical conventionalism.

The driving force of young Ajdukiewicz's philosophical inquiry was his interest in the cognitive role of language. Inspired by the ideas of French conventionalists, especially Le Roy, he wanted to present the latter's free philosophical insights in a strictly scientific manner. As a result, he created his radical conventionalism. First, however, he needed a precise conception of meaning, because the question he investigated was how the choice of language, and the meanings of its expressions in particular, affected the process and outcome of cognition. For this reason, he took up studies in semiotics (Ajdukiewicz 1978j). He developed the meaning-rule conception of meaning, with language understood as a kind of deductive system governed by what he called meaning-rules (Ajdukiewicz 1978g). These meaning-rules prohibited the language user to refuse accepting some of its sentences – either unconditionally (axiomatic meaning-rules), or by virtue of prior acceptance of other sentences (deductive meaning-rules), or in the face of certain experiential data (empirical meaning-rules) – otherwise the meaning of expressions of the language would be violated. Sentences accepted under those meaning-rules constituted, respectively, axiomatic, deductive, and empirical theses of the language. Ajdukiewicz considered as synonymous both expressions of the same language, which were interchangeable within its meaning-rules, providing the latter remained intact, as well as expressions from different languages, which occupied an analogous structural position, each within the meaning-rules of their respective languages. In view of this, meaning was the property – defined by abstraction – common to all synonymous expressions.

Ajdukiewicz proceeded to investigate only the languages he called closed and connected, that is, those in which all expressions were interconnected in terms of meaning by way of meaning-rules and to which no new meanings could be added since they already contained all the meanings from the given relationship network. He called the set of meanings of a closed and connected language a conceptual apparatus, and the set of theses of such a language a world-perspective. Then he formulated the thesis of radical conventionalism: a world-perspective depends on the choice of conceptual apparatus (Ajdukiewicz 1978v). When applied to languages other than closed and connected ones, this conception did not claim anything unusual: only that sentences accepted by virtue of the meaning of their expressions depended on those very meanings. Its originality lay in its application to closed and connected languages and in the assumption that various such languages existed, based on different conceptual apparatuses. Two such languages (since they could not be enriched in a connected way) either used identical conceptual apparatuses and differed only by the sound of their expressions, or used completely different apparatuses that had nothing whatsoever in common. In the second case, those languages were completely mutually untranslatable, that is, no expression of either language had a synonym in the other one. Moreover, a change of meaning of even one expression of a closed and connected language led to a change of the meanings

of all its expressions, and so a shift to another apparatus. This in turn meant a transition to a fundamentally different cognitive perspective.

Radical conventionalism was supposed to give an account of the profound transformations in science, later called scientific revolutions. According to Ajdukiewicz, what changed were not the theories as such but something more fundamental, namely, languages and associated conceptual apparatuses by means of which theories were expressed. A shift to another apparatus made the old theory and the new one mutually untranslatable. Science, therefore, did not develop cumulatively. However, Ajdukiewicz pointed out some evolutionary trends of conceptual apparatuses, which allowed progress in science to take place. He abandoned this conception partly due to the shortcomings that Alfred Tarski had found in the underlying meaning-rule conception of meaning, and partly because he had concluded that the notion of a closed and connected language was empty, and as a result, that radical conventionalism itself did not have a real exemplification. He continued promoting the main thesis of radical conventionalism in a weakened version and a different formulation, applying it to ordinary, actually used languages, though as a result, it lost its clarity and originality.

3.2. Radical empiricism.

While radical conventionalism emphasized the cognitive role of language, in later years Ajdukiewicz seemed to shift to the position of radical empiricism, minimizing that role. He pondered whether it was possible to construct a language governed exclusively by empirical rules of meaning. First, he pointed out the possibility of abandoning axiomatic rules (Ajdukiewicz 1978h), and then also deductive ones (Ajdukiewicz 1978m). He concluded that although it had not been practised before, it was possible to acquire and express knowledge in a language free of all *a priori* components, in which even logic would be based on experience. He also noticed that constructing such a language required a reconstruction of the notion of meaning, which he managed to sketch only roughly (Ajdukiewicz 1978m). This evolution of Ajdukiewicz's views can, however, be seen differently and interpreted as a shift from conventionalism not so much to empiricism as to metaconventionalism (Giedymin 1978). This is because we can choose the kind of language we need: is it supposed to be governed by all types of rules, or only by empirical ones? This choice determines not the meanings of expressions but the idea about what meaning actually is, the acceptance not of the sentences in question but of epistemological theses. Ajdukiewicz also drew close to empiricism by demonstrating that sentences traditionally considered to be analytical required resorting to experience, and specifically to existential premises (Ajdukiewicz 1978o). He thereby initiated a lively debate in Polish philosophical literature on the notion of an analytic sentence.

3.3. Rationalism, realism, classical logic.

Of special importance for Ajdukiewicz were rationalist standards of pursuing philosophy. He shared the view, common in the Lvov-Warsaw School, that the necessary condition of cognitive rationality of problems one investigated was their communicability and intersubjective testability. He coined the term *anti-irrationalism*, which meant rationalism in a broad sense, including empirical methods, as opposed to narrow rationalism that excluded empiricism. He consistently espoused the classical notion of truth, the reality of the outside world, and also classical logic, upholding the principle of bivalence and ungradability of truth. He successfully defended the law of non-contradiction against ideologues who, in the postwar period, resorting to marxist principles, argued that the universality of movement and changes in the world led to inevitable contradictions (Ajdukiewicz 1978b).

3.4. Semantical epistemology and metaphysics.

Although the criterion of intersubjective testability resembles the neopositivist criterion of sense, the Lvov-Warsaw School – in contradiction to the Vienna Circle – did not avoid traditional metaphysical problems. Ajdukiewicz reconciled metaphysical aspirations with the criterion of testability by using his method of philosophical paraphrase: his way of explaining philosophical concepts was meant to make notoriously vague metaphysical problems, expressed through those concepts, graspable and decidable. He tried to combine maximalistic aspirations with the "toolbox" of a minimalist. In his view, metaphysics could be based on epistemology (which he did not see as part of metaphysics). He formulated and pursued the following programme of semantic epistemology: all cognition manifested in language, therefore the study of cognition could be brought down to the study of its linguistic results, i.e. the sentences of the language in which they were expressed. Those sentences, their mutual connections and relationships with reality, were the domain of semantics, based on the achievements of logic. And semantics and logic provided well-founded conclusions. According to his method, only after having arrived at such beliefs about the nature of cognition could we draw metaphysical conclusions about the nature of existence.

In the early period of Ajdukiewicz's work semantics was riddled with antinomies. Therefore, the meaning-rule conception was not based on semantic concepts. Instead of the notion of truth, the notion of a thesis of language played an important role in it. However, Ajdukiewicz did not equate these two notions. On the contrary – as soon as semantics had been cleared of antinomies, he carefully differentiated them. Therefore, it is difficult to understand why later he encountered the ideologically motivated charge that he equated these concepts, and that he based metaphysics on views relativized to language, thereby allegedly turning out to be an idealist (Schaff 1952). This criticism (which Ajdukiewicz did not neglect to respond to [Ajdukiewicz 1995]) was especially poignant for him because the views imputed to him were not only fundamentally different from his own but also ones he himself argued against.

3.4.1. Polemic with neo-Kantian objective idealism. It was precisely for the purpose of this polemic that Ajdukiewicz made a distinction between the concepts of truth and thesis (Ajdukiewicz 1978s). The polemic itself was a model example of his application of the paraphrase method and the use of semantical epistemology in metaphysics. In his view, the main thesis of idealism – that the world did not exist independently but was a correlate of an objective spirit or the transcendental subject – was unclear, and its central idea required an explanation. At the time, idealists conceived of this superindividual subject not as some higher self but a system of ideas and judgments dictated by transcendental norms. These norms were supposed to contain the criteria of truth, while the world as a correlate of transcendence was supposed to depend on truth. This established an ontic order completely contrary to Ajdukiewicz’s philosophical beliefs. In his opinion, criteria did not define truth and truth did not define the world. The truth was (on the basis of a given language) secondary to events in the world, and the criteria of truth were secondary to truth itself. To make the problem of idealism graspable, Ajdukiewicz interpreted transcendental norms as meaning-rules of language, and judgments constituting the objective spirit as language theses dictated by meaning-rules. If the notion of a thesis did not differ from the notion of truth, idealism paraphrased in such a manner would claim that the set of true sentences depended on linguistic rules. And as a consequence, that the world had to conform to the rules of language. In order to reject this view, Ajdukiewicz had to demonstrate that the notion of a thesis differed from the notion of truth. Then language rules would determine the set of theses but not the set of truths, and thus, not the external world. To do this, Ajdukiewicz resorted to Gödel’s theorem, according to which in sufficiently rich languages (and such languages are used in science) one could formulate undecidable problems, that is, such questions that any answer, as well as its negation, were not theses. At the same time, by virtue of the law of excluded middle, one of the two contradictory sentences had to be true. Ajdukiewicz gave an example of an undecidable problem, pointing out that one of the possible answers (though which one, was not known) was true, but it was not a thesis. He concluded that not all truths were theses, and that the directives did not exhaust the richness of the world, therefore idealism was false. If this result may raise doubts, it is only in connection with the accuracy of the paraphrase of objective idealism.

3.4.2. Polemic with subjective idealism. By taking it up, Ajdukiewicz explained in more detail the programme of semantical epistemology (Ajdukiewicz 1978d). Now, in his opinion, metaphysical conclusions could be drawn from reflection on cognition only when the investigated cognitive results were expressed in the language of semantics. Such reflection then addressed the relations of language to the outside world, somehow taking this world into account and offering a cognitive transition to its affairs. This, however, was not possible when such reflection referred only to intralinguistic relations, or possibly also mental phenomena, but did not touch the sphere independent of consciousness. There was then no transition to that sphere and one could not predicate anything about it. According to Ajdukiewicz, this was

actually the kind of language, free of object-related expressions, that subjective idealists used: they spoke only about ideas and their perception, and this did not justify any beliefs about the real external world. Moreover, in contradiction to natural language, they redefined certain expressions (e.g. they conceived of the *body* as a system of ideas). The resulting equivocation created the impression that they used objective language, and so their conclusions about existence – although counterintuitive – seemed justified. In actual fact, all the reflections of subjective idealists took place in the sphere of experiences and sensations, without reaching external reality. Therefore, they could not even deny the existence of that reality. If, however, they uttered such sentences, it meant they were trying to restore object language. This would not do them much good, however, because it immediately violated the meaning-rules of the common language. After all, in the face of certain data, those rules led to the acceptance of such sentences as *these are cats*, and as a consequence, deductive rules required the acceptance of such sentences as *cats exist*. And so the idealists either did not get involved in the object language at all, and had no means to unequivocally deny the real existence of things, or did get involved in it but broke its rules by stating their views. Proponents of the existence of intentional entities were in a better position than the idealists (Ajdukiewicz 1978k). This was because intentional existence was ascertained by empirical criteria (e.g. one had to check what Homer had written about), expressed in object language, the rules of which allowed distinguishing real existence from intentional existence.

3.4.3. Polemic with reism. Ajdukiewicz's ontological interests also included the issue of universals (Ajdukiewicz 1978l). Referring to T. Kotarbiński's reism, he noted that the ontological version of that view, according to which things existed but not universals, was incompatible with the semantic version, understood as a programme of not using apparent names, that is, names other than those of specific things (Ajdukiewicz 1960d). This was because if reists wanted to express the negative part of their ontological argument, they had to use the apparent name *universals*. Granted, they did allow apparent names in sentences, from which those names could be eliminated without a change in meaning, but was this the case here? If the negative argument could be translated into a sentence only about things, it would be at odds with the reists' intentions. And if it could not, the reists would violate their own programme by uttering it. Ajdukiewicz had an impact on the reception of reism in the Lvov-Warsaw School. His critique was resisted only by a weakened version of semantic reism, which came down to the search for reistic substitutes of abstract names.

Moreover, Ajdukiewicz pointed out that natural language did not determine whether all names constituted one semantic category (and accordingly, whether everything existed in the same way) or general names differed categorically from individual ones (and accordingly, whether different entities might exist in different ways). He concluded that the process of language clarification could develop in various directions, thereby leading to different concepts of existence and different

answers to the question about the existence of universals. He held against reism not that it had taken avail of one of those possibilities but that it had ascribed an absolute value to it. He himself preferred to use a language that made ontological room for universals, even though reistic language tempted him with the simplicity of some of its solutions. He stressed the necessity of relativizing ontological considerations to the language in which they were conducted. After all, depending on the language rules, the word *existence* could acquire different shades of meaning. Ajdukiewicz had thereby anticipated the ontology later proposed by Quine, which came down to the ontological commitments of language. In this sense, Ajdukiewicz's ontological interests fit into his broadly conceived research on the cognitive role of language.

3.4.4. Logic and natural language. Nevertheless, Ajdukiewicz did not see in logic the nostrum for all philosophical problems. He delimited the applicability of pure logic to philosophical issues (Ajdukiewicz 1978i). For him, this limit was the necessity of validating each time the paraphrase of a philosophical problem in the language of logic. On the other hand, he criticized the view that logic and ordinary language were incompatible, proposing a pragmatic solution to the paradox of material implication (Ajdukiewicz 1978c). What this paradox comes down to is that certain implicational sentences, true by virtue of the logical interpretation of the implication functor, are unacceptable, which seems to undermine this interpretation. Ajdukiewicz made a distinction between what the sentence asserted and what it expressed. He showed through examples that sometimes a sentence asserted a true state of affairs but expressed such conviction states of the person uttering them, about which we knew from context that he or she could not hold them. In Ajdukiewicz's opinion, that was the reason of the unacceptability of the aforementioned sentences.

3.5. Investigation of the syntax and structure of expressions.

Ajdukiewicz was the creator of categorial grammar and of the notation specifying the syntactic position of expressions, which he successfully used when addressing semiotic issues.

3.5.1. Categorial grammar. The resolution of semantic antinomies resulted in Ajdukiewicz's work not only in semantic epistemology but also in taking up by him of the issue of syntactic meaningfulness of expressions. His categorial grammar – historically, the first grammar based exclusively on the structural properties of expressions – formulates the general criteria of syntactic coherence (Ajdukiewicz 1978t). In other words, it indicates what predetermined steps should be taken with respect to any expression, so that the obtained results automatically show whether the words in this expression are assembled to form a meaningful whole. Ajdukiewicz took the notion of semantic category from Husserl and Leśniewski. He considered a category to consist of expressions that were exchangeable in any meaningful context. He distinguished categories of sentences, names, and functors. He divided functors into subcategories, depending on the category that the expressions those

functors built belonged to and on the number and category of arguments those functors operated on. He developed a notation that assigned to each expression an index of its category. To sentences and names, he assigned simple indices (in the form of letters s and n), and to functors, indices resembling fractions, with the numerator containing the index of the expression that the given functor built, and the denominator containing the indices of all the arguments. To investigate the syntactic meaningfulness of any expression, one had to assemble the indices of all its component expressions, and then to "reduce" indices similarly to reducing fractions, i.e. if any index had its counterpart in the denominator of another index, both of those homomorphous symbols should be cancelled. An expression was syntactically coherent if and only if after making all possible cancellations we obtained a single index. It was not coherent if we were left with more than one index after all possible cancellations had been made. Thus, all sentences, names, and functors were meaningful, but not their accidental combinations.

3.5.2. Syntactical position of expressions. Apart from categorial indices, Ajdukiewicz eventually proposed another notation, which unequivocally determined the syntactic positions of all component expressions in a compound expression (Ajdukiewicz 1978q) (which was not the case with categorial notation). Syntactic symbols of individual words in a compound expression allowed a recreation of its structure even if those words were given in a random order. They gave the notion of a syntactic position a precise meaning, independent of common intuitions. Ajdukiewicz used this notation, when towards the end of his life he sketched a new conception of meaning. He assumed that the meaning of a compound expression was a relationship that ascribed the denotation of each of its component expressions to its syntactic position within the whole. This was based on a simple idea that to understand an expression, one needed to know which fragments of reality the individual words of this expression related to and in what way they had been connected with one another within it. Another late semiotic idea of his was that synonymous expressions evoked in language speakers thoughts that were identical in some essential respects, like the object reference of an expression or its emotional colouration (Ajdukiewicz 1974, 7–15). He did not manage to develop this idea further – exactly which aspects of thought were significant in terms of the meaning of the experiences eliciting them, and which were not, and whether those insignificant ones were incommunicable, and thus non-rational. He also used the notation of syntactic symbols to analyze the relationship between the subject and the predicate of a sentence (Ajdukiewicz 1978u) and for sketching the method of eliminating intensional expressions (Ajdukiewicz 1961, 1978j). His aim was not to remove those expressions from the language but to reinterpret them in a way that would make them extensional. He concluded that the imprecise natural language allowed this reinterpretation, though it did not require it. His concept was to have the functor dissemble the expression not into a few compound arguments, but only into the simplest component expressions. The denotation of a sentence could change when a compound argument of the main functor changed to another one

with the same denotation but not when arguments were taken to be only the simplest expressions (including their syntactic symbols within subordinate sentences). An analogous exchange on the lowest structural level retained the meaning of the whole and its denotation.

3.6. Methodology.

Ajdukiewicz valued scientific knowledge highly and devoted a great deal of attention to it. His scientism was evidenced by reconstruction of scientific procedures, ideas aimed at improving them, and the postulate to base philosophical methods on scientific ones (which he himself pursued). He distinguished two disciplines dealing with science: metascience and methodology (Przełęcki and Wójcicki 1977). The first one was an exact theory of deductive systems. The second one belonged to the humanities and dealt with the activities of scientists and the purposes they seemed to pursue. It also attempted to understand the mechanisms of science and its developmental trends.

Science requires precise, specialized terminology and the ability to formulate problems and to find their valid solutions. Hence Ajdukiewicz's interest in the theory of definition, theory of questions, and the issue of justification. His texts on methodology, innovative at the time of publication, do not differ much from the contents of contemporary textbooks of broadly understood logic. It had been due to his contribution, however, that these contents have been accepted, popularized, and developed further.

3.6.1. Theory of definition. Ajdukiewicz returned to the issue of definition a number of times. He compiled matters relating to definitions, systematized conceptually the foreground of definition theory, and created its foundations. Taking the procedures used in formalized theories as a starting point, he came to the conclusion that not all aspects of the definition theme were reflected there. He distinguished real definitions (that unambiguously characterize an object), nominal definitions (that give translation rules), and arbitrary definitions (or meaning postulates). He pointed out that these three intersecting notions of definitions could not be contained in a uniform general theory, because they were so different in terms of their intension that a superordinate *genus* did not exist for them (Ajdukiewicz 1958).

It is not possible to determine the general form of even just nominal definitions, as they have to be relativized to their languages, and the latter differ in terms of meaning rules. Only some principles of constructing definitions apply to all languages. Ajdukiewicz distinguished analytic and synthetic definitions. He characterized types of definitions with different structures. He recapitulated and collected the conditions of correctness and usefulness of definitions: formal (e.g. conditions of consistency, non-creativity, existence, and uniqueness), semantic (e.g. adequacy condition), and pragmatic (e.g. avoiding the fallacy of *ignotum per ignotum*). He noted that not all kinds of definitions gave the translation of the defined term directly, but under certain formal conditions they allowed translatability. He showed how to formulate definitions to ensure translatability.

He did not share the view of nominalists who, denying the existence of species, considered all definitions nominal. He believed that such an approach left no room for inquiry into what certain things were, limiting attention to what their names meant. He noticed that at an early stage of development of a scientific discipline, primarily criterial definitions were formulated. Then, as research moved deeper into phenomena, criteriality gave way to grasping the essence of things, understood as those properties of things, from which, based on natural laws, the other properties could be deduced. In this way, the conceptual framework was gradually penetrated by knowledge of empirical origin. This corresponded to Ajdukiewicz's observations that conceptual apparatuses tended towards rationalization (i.e. the process of making originally empirical problems decidable in a purely conceptual sense, by way of language modification) and that empirical components did exist in sentences traditionally considered analytic, in particular in arbitrary definitions.

3.6.2. Theory of questions. Ajdukiewicz proposed a useful terminology that referred to Twardowski's proposals and proved convenient for the logical analysis of questions and answers. He defined the range of the unknown of a question, positive and negative assumptions of questions, as well as didactic, captious, and suggestive questions. He distinguished decision questions and complementation questions; questions posed properly and improperly, and proper, improper, and correcting answers; partial, complete, and exhaustive answers; and direct and indirect answers.

3.6.3. Rationality of inferences and foundation of sentences. In the time when induction logic was taking its first steps, Ajdukiewicz tackled the problem of the rationality of fallible methods of inference. He considered a fallible inference rational when in the long run, actions based on it brought more profits than losses, that is, the degree of subjective certitude with which the conclusion was accepted did not exceed the degree of reliability of the scheme of the applied inference. He assumed the degree of acceptance of the conclusion could be calculated based on behavioral criteria, and that the degree of infallibility of the scheme was the relative frequency of achieving true conclusions based on it, providing the premises were true (he was aware this explanation was incomplete because in practice the data for calculations was unavailable). He pointed out that whereas previously the rationality of inference had been based on probability theory and had relied only on a sense of obviousness, he demonstrated the correctness of such an approach in view of a general pragmatic theory of rationality, associated with the balance of profits and losses.

However, Ajdukiewicz did not see in this solution a way leading to the formulation of criteria of justifying sentences. On the contrary, in the field of justification he perceived still unsolved problems that others did not. He came to the conclusion that the very notion of justification, central in methodology, was unclear. At the same time he admitted that in science, justification or rather the sense of justification was a fact. He outlined a methodological programme aimed at explicating that notion. In his view, even though methodology had reconstructed various types

of induction, we still did not know what distinguished inferences approved by scientists, since after all, they did not consider each generalization justified. This would have to be investigated, and based on this, the notion of justification recreated. As far as deductive sciences were concerned, it would involve determining what conditions imposed upon assumptions and rules of transformation would guarantee justification of secondary theorems. From a broader perspective, such a programme would proceed to a reconstruction of the scientific method and to the determination of its capabilities and limitations. Ajdukiewicz returned to the issue of justification many times, taking up more detailed problems.

3.6.4. Classification of reasonings. He performed a methodologically useful classification of reasonings, combining their various divisions: into simple and complex ones; into deductive and nondeductive ones, and among the latter, into rational and logically valueless ones; further, into those based on inference and those based only on hypothetical derivation of given sentences from others; into spontaneous and task guided ones, and among the latter, into those directed by decision questions, by complementation questions, and by the task of performing a proof. He took a critical view of the earlier classification elaborated by Łukasiewicz and modified by Czeżowski, which in his opinion missed part of the logical reality (Ajdukiewicz 1965b).

3.6.5. Classification of sciences and axiomatic systems. Regarding types of inferences, Ajdukiewicz distinguished deductive and nondeductive sciences, and regarding ultimate premises that were not subject to justification, he distinguished deductive sciences based on axioms, empirical sciences based additionally on observational sentences, and the humanities, based additionally on interpretations of other people's broadly understood utterances. He specified stages of development of deductive sciences (preaxiomatic, intuitive axiomatic, and formalized axiomatic). Actually, the very beginnings of his activity involved reflection on axiomatic systems, thus paving the way in Poland for the development of deductive disciplines (Ajdukiewicz 1966). Only later did he turn from metascience to methodology (and even though he had considerable achievements in the latter, in the last years of his life he expressed regret about not having been involved in it enough earlier on). In the period of his metascientific investigations he formulated structural definitions of the notions of logical proof and logical consequence, and got involved in proofs of consistency and the concept of existence in mathematics; he pointed out how to strengthen the foundations of contemporary predicate calculus in order to derive traditional syllogistic from it; and he investigated the conditions of reversibility of premise and consequence.

Later on, he classified axiomatic systems, combining two of their divisions: into reductive and deductive ones, and into hypothetical (i.e. neutral) and assertive ones (Ajdukiewicz 1978a). He performed a critical analysis of the ways of justifying axioms in assertive-deductive systems, and presented the possibility of limiting deductive sciences to uninterpreted, formalized neutral systems. He saw hypothetical-reductive systems in empirical sciences that passed from consequences to premises

and at the same time aspired to the formulation of precise theories. Such a methodologically uniform classification partially eliminates the gap between deductive and empirical sciences.

3.6.6. Reconstruction and evaluation of scientific procedures. Ajdukiewicz reconstructed such procedures as generalization of observations, testing of hypotheses, formulation of theories, or revision of principles (Ajdukiewicz 1974). He distinguished various types of natural laws, according to the dependencies they described. He devoted particular attention to statistical laws. For various kinds of fallible reasonings, he presented a method for calculating the degree to which assumptions increased the probability of the conclusion on the basis of accepted knowledge. He came up with a number of interesting theorems about the impact of evidence on the degree of validation of hypotheses and generalizations. They allowed a comparative evaluation of the degree of validation of laws, but not an absolute evaluation (and here Ajdukiewicz saw the possibility of further research). He proved the rationality of strategies usually used in science for increasing the degree of validation of laws.

He critically examined ways of justification adopted in the empiricist tradition. He considered justification that appealed to observations unscientific because direct observation was neither intersubjective nor reproducible (another observation, although similar, was never the same as the previous one). The scientific method, however, required intersubjectivity and repeatability. Scientificity began with generalizations that – paradoxically – were based on an unscientific foundation. However, Ajdukiewicz did not join the critics of direct justification, who referred to the theory ladenness of observations. On one hand, he minimized the role of terminological conventions, and on the other, he emphasized it. He minimized it by demonstrating that for justifying analytic sentences, conventions required supplementing with existential premises. He emphasized it by demonstrating that problems in science, which were seemingly solved arbitrarily (e.g. *what time measurement is really accurate?*), were based on implicitly accepted conventions that specified the meaning of certain vague expressions (e.g. *a reliable time measurement device*), thereby assuring a precise meaning, graspability, and decidability of certain problems (e.g. *are two given time periods equal?*).

Following Twardowski, Ajdukiewicz understood the humanities antinaturalistically. He categorized them as idiographical ones (e.g. history), nomothetical ones (e.g. psychology), and evaluative ones (e.g. cultural studies). The evaluative ones were supposed to reveal the values being the goal of human actions, and to evaluate the effectiveness of those actions. In psychology, contrary to the neo-positivists, he rejected physicalism and psychophysical reductionism but accepted introspection.

3.7. Axiology.

Ajdukiewicz did not focus on axiological problems only in the context of methodology of the humanities. His metaethical views were close to intuitionism, although he considered the concept of intuition vague and preferred to talk about feeling

or conscience (Ajdukiewicz 1960c). He considered values objective and knowable through feelings. He objected to defining values in terms of feelings. This, he wrote, would resemble defining the properties of things in terms of sense impressions. In his view, empirical properties and values were primary, and the reception of both secondary. He saw also other analogies between axiological and empirical cognition: in both cases one began with direct experience and in both cases the cognitive faculties – whether feeling or the physical senses – were sometimes fallible. Then experience was generalized and principles (moral or empirical) formulated. After that, in both areas individual sentences (resp. judgments or descriptions) could be justified directly or indirectly, by inferring them from principles.

Ajdukiewicz was interested in psychology and human behaviour, and he characterized a number of important concepts in that area. Prudence and the ability to reflect were the traits in people he valued more than spontaneous abandon. In terms of seeking satisfaction in life, he encouraged keeping a healthy balance between the pursuit of specific goals and the enjoyment of one's current activity (Ajdukiewicz 1965c). He performed a thorough examination of the notion of justice (Ajdukiewicz 1960b).

One of his concerns was education in logic and philosophy. He called for the promulgation of logical culture and presented concrete ideas how to go about it. He authored a few logic and philosophy textbooks designed for students of various levels.

4. Disciples and continuators

Ajdukiewicz was a great animator of scientific life. He initiated many kinds of research, sketching programmes of their further development. Some of the problems he had addressed were later continued by his disciples, many of them prominent in their own right. He supervised Master's or PhD dissertations of the following persons: Zygmunt Schmierer (who did not survive the war and could not develop his interests), Stefan Swieżawski (metaphysics, history of philosophy), Jerzy Giedymin (methodology of history and social sciences, conventionalism), Roman Suszko (logic, epistemology) Henryk Skolimowski (analytic philosophy, axiology), Adam Nowaczyk (logical foundations of language and cognition). He also had an impact on the scientific development of such philosophers as Henryk Mehlberg (philosophy of mathematics and of empirical sciences), Maria Kokoszyńska-Lutmanowa (philosophy of science, methodology), Izydora Dąmbska (semiotics, history of philosophy), Seweryna Łuszczewska-Rohmanowa (theory of knowledge, language of science), Janina Hosiasson-Lindenbaum (probabilistic validation of fallible inferences), Klemens Szaniawski (logic of fallible inferences in the context of decision theory and the theory of rationality), Halina Mortimer (induction logic and its history), Jerzy Pelc (logical semiotics), Witold Marciszewski (pragmatic aspects of cognition, artificial intelligence), Marian Przełęcki (semantic reconstruction of

empirical theories, metaethical intuitionism), and Ryszard Wójcicki (pragmatic reconstruction of empirical theories).

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