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Organon 18 19, 143-159

1982 1983

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I. INTRODUCTION

When in 1595 Jan Zamojski founded the Zamość Academy, he also ordered a new program of lectures in Aristotelian and Stoic logic for it. Yet, there were no textbooks for students in this subject. Encouraged by the Academy's founder, the dialectician and moral philosopher Adam Bursius, a lay professor at the Academy, then wrote a monumental, source-based textbook of Stoic logic called *Dialectica Ciceronis* (1604). Written in Greek and Latin, this book gave a statical presentation of the ancient two-valued Stoic logic of propositions. Bursius' premature death in 1611 foiled his design to write a textbook of Aristotelian, or Peripatetic logic as provided for in the Academy's teaching program. Several years later this task was taken up by the logician and theologian Marcin Śmiglecki (Smiglecius, 1564–1618), a Jesuit who was professor at the Wilno Academy. As graduate of the Lwów school (1597) he was picked by hetman Jan Zamojski as future lecturer for the Zamość Academy. Zamojski paid for Śmiglecki's studies at the Jesuit college of Pułtusk (1580). After joining the Jesuits in 1581, Śmiglecki studied in Rome and Wilno (1582—86), and eventually he became professor at the Wilno Academy. Although he was neither student nor professor at the Zamość Academy, Śmiglecki cherished a sense of attachment to this school, mainly because of his scholarly contacts with its founder and its professors. Śmiglecki indicates this in the Dedication Epistle addressed to Tomasz Zamojski, the Zamość heir-in-tail, in his latest work: „To the Most Honourable and Generous Lord Tomasz Zamojski, Son of the Great Jan Zamojski, Starost of Knyszyn... the Author sends his greetings and the fruit of his work. This is its title: Logic by Marcin Śmiglecki, of the Society of Jesus, Doctor of Holy Theology, illustrated with selected disputations and questions, divided into two volumes, in which whatever in Aristotle's Organon is necessary to know or obscured by ambiguity is clearly and transparently as well as meticulously and vividly presented, complete with a list of contents for the Most Honourable and Magnificent Lord Tomasz Zamojski... by the grace and privilege of His

Imperial Majesty released in Ingolstadt by printer Ederian at widow Elizabeth Angermaria's premises A. D. 1618." (*Logica Martini Smiglecii Societatis Jesu, S. Theologiae Doctoris selectis disputationibus et quaestionibus illustrata et in duos tomos distributa in qua quicquid in Aristotelico ORGANO vel cognitu necessarium vel obscuritate perplexum, tam clare et perspicue, quam solide ac nervose pertractatur cum indice Rerum copioso ad Perillustrem ac Magnificum Dominum, Dominum Thomam Zamoscium et c. cum gratia privilegio sacrea Cesareae Maiestatis Inglostadii ex Typographico Ederiano apud Elizabetham Angermariam, viduam, Anno Domini MDCXVIII*).

Two years before, Śmiglecki's *Organon Logic* had received his order's approval, which reads: "I, Stanisław Gawroński, Jesuit, superior of the Society's Polish province, on the ground of powers bestowed upon me by the Right Respectable Father Mutio Vitellescho, our general superior, agree herewith that the *Logic* of Father Marcin Śmiglecki, member of our Society, having been approved by respected and learned men, be given to the printers. To confirm which we edit this letter signed in my own hand and supplied with a seal in Kalisz on June 24, 1616." In the Dedication Epistle Śmiglecki writes, "To Your Father I owe ever-lasting memory not only of his benevolence for me but also of his extraordinary generosity. To him I dedicate the fruit of my studies (the *Organon Logic*), as he encouraged me to continue my efforts. He always... was guided by noble principle alone; on the most significant matters he said his mind with conviction and prudence; he was fully lord of his time and his deeds. In all this he distinguished himself by never disparaging any work... His own private benefactions to me... were such that it was proper for me, nay even obligatory, to cherish a sense of gratitude toward him. Our works (in the domain of scholarship) were similar in a unique way: from my young days I felt an insufficiency of knowledge, while his works earned him an affluence in unenvied renown among rhetoricians, a fullness of wisdom among philosophers, an excellence in jurisprudence among jurists, and great linguistic skills among polyglot men. He felt called to be the proper founder of the Zamość Academy. He asked our pertinent advice on this matter. Despite this partial dependence on us, effects of the nightly organization efforts went to his credit so much that, although they cannot be attributed to any individual name and should be regarded as the fruit of endeavours of the entire working group, ultimately he can be acknowledged to deserve the praise without fearing a mistake. After pitiless Death took this unrivalled Hero, Your Father, away from us (1605), we have preserved those very nightly scholarly toils as a token of gratitude to his soul... It is You, in whom your Father's virtues glow so magnificently, that I proclaim my sponsor. It was Your Father who commenced so extensive scholarly inquiries, while You performed in this work so bravely that You exceeded the boldest expectations of all scholars in disciplines cultivated in accordance with the tradition of our forefathers... These beginnings of Your actions augur... great prosperity and glory for us. In keeping with the whole community's desire, we want to see you grown up as soon as pos-

sible, we desire it and look forward to this. Fare well, my Lord! Given at the Karnkowski Jesuit College in Kalisz on August 15 A. D. 1618."

So, the *Organon Logic* was endorsed by the Jesuit General and approved by His Majesty the Emperor. The author thanked the deceased Chancellor for his sponsorship and recommended himself to his son, the young heir-in-tail Tomasz.

Jan Zamojski's outstanding personality enabled him to create something like an intellectual school in Zamość, although it cannot be compared for its scale to the later philosophical Vienna Circle (the *Wienerkreis*) or the Lwów–Warsaw Logical School. The Zamość centre was pervaded by a spirit of honest scholarly effort. This was the background for the *Organon Logic*, a new textbook of Aristotelian, Peripatetic logic.

Śmiglecki's work is composed of two volumes. The first includes 11 disputations in 98 questions as well as considerations of six basic categories (*praedicamenta*). The second volume includes 7 disputations in 87 questions. The whole is a 1620-page quarto-folio Logica maior et minor, because it comprises epistemology, Peripatetic syllogistics and theory of science (methodology). The division into two volumes is not a division into epistemology and logic proper, or theory of science, as their motifs intertwine throughout the two volumes. The *Organon Logic* was a textbook for students of philosophy and theology, who had a knowledge at the levels of *trivium* and *quadrivium*. While it was a commentary to Aristotle's *Organon*, it differed in structure from the original work. It was divided into three parts, depending on the level of rational operations. We shall follow this gradation of Śmiglecki's exposition (with repetitions in different logical contexts). Logic studies operations of reason conducted in keeping with appropriate method and definition, division and demonstration. The correctness of these operations can be explored in two ways; first, either *a priori*, by grasping the self-evident nature (structure) of these operations, and, second, *a posteriori*, by applying external rules. As a skill logic is neither speculative nor practical, for it is essentially instrumental, subservient to other disciplines. It is in particular necessary for disciplines in which arguments are not self-evident.

II. THE FIRST LEVEL OF RATIONAL OPERATIONS

1) The first operation of reason is simple observation, or a direct perception of an object. Reason, in perceiving an object directly, is aware of it by ordinary self-evident perception, without any assertion or negation of it. Reason's first operation is expressed in a naked perception of an object without any ensuing judgement on it. This is an impression. This operation ends with an act of abstraction. Its outcome is a notion; as a universal, notion is a unity referring to multiplicity. Knowledge reduced to universals. By way of abstraction, in which general notions are created, reason in a sense extracts the common nature (essence) of objects from all individual properties of these objects.

2) There are five fundamental universals, or predicables (*universalia*): Genus, Species, (specific) Difference, Property and Accident. These universals are used in making judgements, and then they are called predicables (*praedicabilia, kategoremata*).

3) These five predicables must be distinguished from ten categories (*praedicamenta*). By categories are meant terms expressing ten different modes of existence of natural objects.

4) Terms are univocal, equivocal and analogous. A term is univocal if it is a single name denoting one object as its proper referent. An equivocal term, like "dog", is a general designation for many referents. In view of the different meanings a term may have, Peripatetic logic had to tackle the question of analogy. Analogy occurs in two versions: first, as analogy of attributes (*analogia attributionum*), and, second, as analogy of proper proportionality (*analogia proportionalitatis propriae*) and of metaphorical proportionality (analogia proportionalitatis metaphoricae). A general term is analogous by analogy of attributes when it is asserted (equivocally) in different meanings about different though common referents, or in one meaning (univocally) on account of a recurrent substantial factor in them, as in "healthy" (man, drug, complexion, food). A term is analogous by analogy of proper proportionality when it is asserted about a factor significant for many things but which manifests itself in various degrees in these things, say "being" (of substances, attributes). Finally, a term is analogous by analogy of metaphorical proportionality when it is equivocally asserted on the difference in nature but univocally on action of a referent, as in "smile" (of a person, of the Sun).

5) Being takes ten forms, or modes, and this is why there are ten categories (*praedicamenta*) of manifestations of being. A category denotes many genera and species subordinated to one supreme genus. A category is an assembly (series) or set of generic and specific predicables (*praedicabilia*). Genera and species are elements of the set of generic and specific elements, yet they are not their own elements. A category takes its name from the first supreme element of the set. The list of categories reads as follows: 1° *Substantia* — subject, object, 2° *Quantitas* — size, 3° *Relatio* — relation, 4° *Qualitas* — quality, 5° *Actio* — action, 6° *Passio* — passivity, 7° *Quando* — time, 8° *Locus* — place, 9° *Situs* — situation, 10° *Habitus* — disposition. Whatever is asserted about reality can be referred to five predicables (*praedicabilia*) connected with ten categories (*praedicamenta*). Every category can be submitted to specialization by selecting its genera and species. Porphiry (232–304) made the following specialization of the first category, *substantia* (*the arbor Porphyriana*): 1° *Substantia*, 2° Body, 3° Organism, 4° Animal, 5° Man. Śmiglecki did not use Porphiry's model to derive his own "crowns" of the ten category-trees. His own specialization and generalization in this respect has the character of sets of pertinent materials which must be put into order.

6) To conclude this recapitulation of the first level of rational operations it

should be stated that it refers to impressions, visions, general notions, five predicables (*quinque praedicabilia*), to univocal, equivocal and analogous terms, to ten categories (*decem praedicamenta*), and to relations between them. This is a range of problems proper to the traditional logic of designations (term-logic).

III. THE SECOND LEVEL OF RATIONAL OPERATIONS

Śmiglecki calls reason's second operation composition (*compositio*) and division (*divisio*). Composition is expressed in affirming (*affirmatio*) the link between the predicable with the subject of a proposition, while division manifests itself in denying (*negatio*) such a link. In either case, something is asserted (*enunciatur*) either affirmatively (*affirmando*) or negatively (*negando*). Such an assertion is called a grammatical proposition (*enunciatio*).

1) Let us explain the foundations of a grammatical proposition (*enunciatio*). These foundations include designation (*nomen*), word (*verbum*), essence of things (*essentia*), species, and properties (*proprietates*). Expressions (*voces*) are signs both of things and notions. In combination with notion an expression means something and signifies a definite thing. Expressions in combination with notions are signs of things. Signs are either manifestatory or suppositional. A manifestatory sign (*signum manifestum*) indicates a thing (as smoke indicates fire). A suppositional sign (*signum supositivum*) so closely denotes a thing that it is taken for the thing itself (the sign 7 is taken for the number "seven"). Expressions are substitute signs for things, are designations of things (*nomina*). Designations first denote things, then notions. In colloquial language, designations do not signify things in a natural manner, but arbitrarily (*ad placitum*). Hence the multiplicity of languages in mankind. Designation (*nomen*) and verb (*verbum*) are fundamental components of proposition. Designation is a proposition's subject (*subiectum*), verb is its predicate (*praedicatum*). Designations denote things, verbs denote actions. Infinite designations are marked by built-in negations (non-human). The word "est" denotes the time of duration of things, although duration is not always real.

2) Logical proposition. Śmiglecki took over Aristotle's verbal definition (*ut voce sit*) of logical proposition. A logical proposition is a true or false utterance (*oratio*). A true proposition, when it asserts something about something (*aliquid de aliquo enunciat*) is called propositional statement (*enunciatio*); when it presents the meaning of a statement it is called interpretation (*interpretatio*); when it occurs in a syllogism it used to be called logical proposition (*propositio*; hence the later name of propositional logic); when it leads to an appropriate conclusion it is a premiss (*praemissa*); when it is a topic of discussion it occurs as a question (*quaestio*) or as a problem (*problema*); finally, when it denies as adversary's opinion it is regarded as a tough stand in dispute (*instantia*). Logical propositions are necessary (*pro-*

positiones necessariae) or contingent (*propositiones contingentes*). A logical proposition is true when its predicable refers to the essence of a thing or to an attribute of the thing such that necessarily follows from this essence. Contingent propositions may not always be true because the predicable's essential content may not necessarily be connected with the subject's essential content. They are true only when a non-necessary predicable temporarily remains in a correct link with the subject. Truth or falseness of contingent propositions referring to a present or past reality is easy to state, but it is hard (*difficultas*) to assess the truth or falseness of contingent propositions referring to future events the occurrence of which cannot be presently determined (the domain of autodeterminism). No clearly true propositions can be made about such events. All that can be done is to make probable propositions about such events. A probabilistic judgement expresses adoption of a third logical value, intermediate between truth and falseness. This would betoken an intuition of three-value logic. Śmiglecki had no such intuition, for his is just a two-value logic.

3) The content of a propositional utterance is the information this proposition contains. This is the meaning of the proposition and is called logical judgement. Truth of judgements may be triple — transcendental, moral, and logical. Transcendental truth pertains to a judgement which asserts correspondence of a thing to its objective structure. Moral truth pertains to a judgement corresponding to the thinking it expresses by its content. Logical truth pertains to a judgement corresponding in its content (*iudicium conforme*) to the studied reality. Truth or falseness pertains to propositions (judgements) only in the indicative mode (*modus indicativus*), and does not pertain to propositions in the imperative mode. These are neither true nor false propositions.

4) Practical propositions are true when they are effective in action; when they are not so, they are false. Ontological contradiction refers to the domain of existence: being and non-being, and it is always false as an entirety. Logical contradiction occurs in the domain of indicative propositions: affirmative (p) and simultaneously negative (Np). Between these two there are no propositions of intermediary value (*inter extrema non datur medium*) in the system of two-valued logic. This brings us to a definition of contradiction: Contradiction is the opposition of a proposition and its negation with no intermediate value in between them. Contradiction KpNp must fulfil the following conditions: 1^0 the same thing must be affirmed and denied, 2^0 this must be done in the same respect, and 3^0 at the same time. Two contradictory propositions can be neither simultaneously true nor simultaneously false. Śmiglecki is not aware of psychological contradiction. The types of propositions he discusses are based on designations of things as basic elements of the theory of predicables. Reason's second operation refers to grammatical sentences, logical propositions, judgements, practical, necessary and contingent propositions, if they are considered only within the scope of term-logic.

IV. THE THIRD LEVEL OF RATIONAL OPERATIONS

1) At this level, reason's operation is called discourse (*discursus*), or transitive reasoning, because it resembles transition of things. Like things move from place to place, reason in discourse as if moves from one act of cognition to another. Things move in space, while reason is active merely by unfolding the process of cognition. This latter consists in deriving one proposition from another, that is, in substantial inference (*illatio*). This illation is a C11 = 1 type of implication. Illation is composed of two parts: an antecedent (*antecedens*) and a consequent (*consequens*). The content of the consequent is determined by the content of the antecedent. If the antecedent is accepted, the consequent follows. Substantial inference, then, is involved. Discourse unfolds according to the modus ponendo ponens, "*Si... Atqui... Ergo...*" = "Cpq. And p. Then q." The starting-point in discourse is illation, which occurs in the first proposition "*Si...*" The particle "*Ergo*" is a sign of substantial linkage of the conclusion with the premisses "*Si*" and "*Atqui*", and it is called illative inference particle (*particula illativa*). In its entirety, discourse is a rule of inference composed of three propositions (*tria iudicia enumerativa: Maioris, Minoris et Conclusionis*). Illation is a formal component of discourse (*illationem esse partem formalem discursus*). Discourse is a composition of propositions (*discursus — compositum*). Discourse is much broader in scope than illation. Illation is a premiss in discourse. Discourse comprises premisses and the consequent conclusion: "If p, then q. And p. Then q."

2) All knowledge and discoursive teaching starts with pre-reflexive cognition. Pre-reflexive, pre-scientific cognition (*praexistens cognitio*) becomes reflexive cognition by means of applying the rules of: induction (*primo inductione*), sufficient reason (*secundo ratione*), ontological link (*propter necessariam connexionem rerum inter se*), and the condition of knowledge of principles (*ex cognitis principiis*). Induction is used to phrase general propositions on the basis of an appropriate number of specific propositions. The rule of (sufficient) reason permits to derive a specific proposition from a general proposition. The rule of ontological link permits to derive a proposition from another when the facts referred to in these two propositions have a common cause. Knowledge of principles permits to derive new scientific conclusions from these propositions as general premisses.

3) Syllogisms are composed of three constitutive elements: recognizing the subject of conclusion, recognizing the predicable of conclusion, and knowing the principles, or rules, of inference. The subject of conclusion is what assertions are made about. The predicable of conclusion is what is asserted about the subject of conclusion. Principles, or rules, of inference are the factors, premisses, owing to which the link of the conclusion's predicable with the conclusion's subject is established. In these rules, too, exists the intermediate term (*terminus medius*) of the syllogism. It is actually the causal factor of the conclusion. The three figures of syllogism must necessarily be learned before. The principles, or rules of syllogism

should be recognized before the conclusion and be more certain than the conclusion itself. The principle of contradiction (*principium contradictionis*) ranks highest among the principles. The subject's designation must not be empty. The subject's existence is the prerequisite for asserting about it what is being asserted. To draw a conclusion it is necessary that principles should be true, for a conclusion's truth derives from the truth of principles. Philosophers initially called the prereflexive recognition of principles "agent", because it as though spurs one to well recognize a conclusion; secondarily they called it "director", because it leads one toward the pursued conclusion. Aristotle furnished the following definition of syllogism: Syllogism is an utterance in which, by assuming something, something else necessarily follows, because this assumption does exist. Conclusion should differ from premisses (*conclusio aliud quid a praemissis*). Identity of conclusion with premisses is inadmissible. There is no illation between identical propositions, nor is there discourse between them. Necessity of consequence (*necessitas consequentiae*), or necessity of the relation of consequence is established in syllogistic form according to two principles, or rules: "*Quidquid de omni...*" and "*Quidquid de nullo...*" These two principles are not properly premisses but represent what is called logical principles (canons) of syllogism. They are canons of syllogism's scope. Necessity of consequence (*necessitas consequentiis*) is established in a necessary link of three terms with each other: the external terms are linked with the intermediate term in a necessary manner. A scientific, or demonstrable, syllogism is necessary by recognizing the necessary premisses. A probabilistic syllogism is necessary by assuming contingent, accidental premisses. In it, it may happen that a true conclusion follows from false premisses. However, from true premisses no false conclusion can follow. A substantially conclusive syllogism is also a demonstrable syllogism. A syllogism is an utterance which comprises premisses and conclusions. It is a transitive reasoning (*discursus*) bearing the characteristics of a causal relation (*secundum causalitatem*). As discourse it is based on illation. Philosophers adopted as an axiom that in a syllogism conclusion follows from the worse premiss, that is, from a minor or negative premiss. The qualitative and quantitative property of premisses affects, respectively, the conclusion's value. The limited validity of a premiss passes over onto the conclusion. Such a limitedness finds expression in impossibility, contingency, nonobviousness, specificity and negation. The other principles of syllogism include the substantial metaphysical principles of identity and difference. The principle of identity (*principium identitatis*) says that if two terms are in conformity with a third term then they are also in conformity with each other. This is an *a priori* principle; if applied in a syllogism it may lead to a misunderstanding, which consists in that in the conclusion one knows no more than in its premisses. The conclusion adds no new knowledge other than that furnished by the premisses. A similar charge will be launched by John Stuart Mill against the Peripatetic syllogism in the 19th century. Śmiglecki tries to defend the syllogism by arguing that the principle of identity is the foundation of syllogisms but applied with some limitation (*cum certa limita-*

tione). Neither Śmiglecki nor Mill noticed the circumstance that the relation of a conclusion's subject to its predicable does not occur in the syllogism's premisses, for it is not a repetition of either of these taken separately. It is something new and points to the knowledge-generating nature of the syllogism. The principle of difference (*principium discrepantiae*) says that two terms, one of which is in conformity and the other is not in conformity with a third term, are not in conformity with each other. So, there are four principles of the syllogism: 1° "*Quidquid de omni...*" 2° "*Quidquid de nullo...*" 3° *Principium identitatis*, and 4° *Principium discrepationis*. They agree with the *principium contradictionis*. Having discussed the four principles of the syllogism Śmiglecki underlines the significance of the rule concerning decomposition of the intermediary term. This term must be taken in the major or minor premiss in its entire scope, that is, it should perform the role of subject of a general proposition: M a P, M e P, or the role of predicable in a negative proposition: S e M, S o M.

4) There are four kinds of discursive reasoning: syllogism, enthymeme, induction, and exemplification. Syllogism as a model (*Si... Atqui... Ergo...*; or, M a P. And S a M. Then S a P) has already been discussed. Enthymeme is an abbreviated syllogism; one premiss is omitted, and conclusion follows from the other premiss. Unless substantial consequence occurs in an enthymeme, this latter is not a discursive reasoning. Induction consists in deriving a general conclusion from several specific propositions. Exemplification is inference from one specific, indicative, model proposition about another specific, parenetic proposition. A comparison of the four kinds of discourse shows that in syllogism conclusion follows from two premisses, in enthymeme from one premiss (the other being disregarded), in induction from a conjunctive set of specific propositions, while in exemplification from a model proposition follows a parenetic proposition. Illation lies at the ground of these kinds of reasoning.

5) Syllogism are demonstrative (demonstrable, apodictic, scientific), topical (dialectic, probabilistic, hypothetical), or sophistical (false, erroneous, apparent, misleading). Following Aristotle, Śmiglecki furnishes a dual definition of syllogistic demonstration: 1° Demonstration is a knowledge-generating syllogism, and 2° Demonstration is a syllogism composed of true, first, direct, better known, logically primary and causal premisses. The two definitions are convergent: the former points to the conclusion, the latter to the syllogism's premisses. Apart from syllogistic demonstration, there are two ways of acquiring knowledge, of producing science: by specifying first principles, and by definitions. First principles are recognized directly by understanding their terms and component expressions. The proposition "A whole is larger than its own part" is such a first principle. The truth of this principle is arrived at by intuitive comprehension of its meaning without any demonstration. Knowing something syllogistically means knowing something demonstrably. Scientific knowledge is causal cognition: something is so and so, and cannot be otherwise. Discursive knowledge derives from pre-reflexive and reflexive cognition.

It is perfect, because it relies on causal and necessary relations. Demonstrative syllogism is a logical argument which, once reason has accepted it, produces a state of knowledge in it. Definition is acquisition of knowledge in a nonsyllogistic manner. Definition takes advantage of logical division. The "Porphyrean tree" is one example of applying (dichotomic) logical division to define Man. By this definition, we acquire knowledge of the essence of Man as a rational animal: Man is a corporal, live, sensual and rational being (*Homo est substantia corporea, animata, sensibilis et rationalis*). Premisses of demonstration should be true (*verae*). True propositions are certain. In Peripatetic philosophy, truth of proposition (*veritas propositionis*) consists in accordance between its substance and the recognized reality. Certainty of a proposition's truth (*certitudo veritatis propositionis*) consists in self-evident accordance between this proposition's substance and the reality recognized. It is erroneous to believe that the same proposition can be simultaneously true and false: N K p N p. Premisses of demonstration should be direct (*immediatae*). Immediate proposition is a proposition which is true, but not demonstrated, that is, not derived from a prior proposition. Were this not so, it would be necessary to make demonstrations back indefinitely. Immediate propositions are: essential propositions, which express the essence of a real thing (*homo est rationalis*), causal propositions (*rationale est risibile*), and negative propositions (*quantitas non est qualitas*). These propositions require no demonstration. Premisses in demonstration should be more primary (*priores*) and better known from nature (*notiores natura*) than the ensuing conclusion; more primary, because they are causes of the conclusion, and better known, because they are recognized prereflexively earlier and because conclusion is recognized in dependence on them. To get to know reality it is necessary to carry out a demonstration based on premisses reflecting actual causes of things. They are internal causes—both material (*c. materialis*) and formal (*c. formalis*)—and external causes: causal (*c. efficiens*) and terminal (*c. finalis*). Every demonstration takes advantage only from causal premisses which suffice for getting to recognize a given thing in the conclusion. Scientific demonstration should therefore be causal and necessary. Causality in demonstration requires that its premisses be true (*verae*), direct (*immediatae*), prior and better known (*priores et notiores*) as well as effective (*esse causas conclusionis*). Necessity in demonstration requires that premisses be general propositions (*de omni*), express directly (*per se*) the existence of things, and contain in themselves first and most general predicables (*termini universales*). Premisses should state that things are so and so in reality and that they cannot be otherwise. From necessary conclusions follows a necessary conclusion.

6) The best, distinctive demonstration (*demonstratio potissima*) is one in which both its premisses and the conclusion themselves contain first and most general predicables. Principles are the starting-point in a distinctive demonstration. They are either proper (*propria*) principles, say, "Man is a rational being", or common (*communia*), say, "Man is an animal," or "Brutum is an animal". Proper principles are applied when the intermediate term belongs to the same scope of meanings to

which the subject of the demonstrated proposition belongs (rationality–humanity). Common principles occur in demonstrating a specific feature of species subject (Man's sensuality is demonstrated by means of the generic term "animal"). Common principles may be applied in demonstrations in subordinated sciences (mathematics–music). However, such demonstrations are not distinctive demonstrations (*demonstrationes potissimae*). Following Aristotle, Śmiglecki outlines an ideal of distinctive demonstration to be followed by all scientific demonstrations. Their degree of perfection will be measured by the extent to which it approximates this ideal. This latter is unattainable in practice. The "Propter quid" and the "Quia" demonstrations are representatives of distinctive demonstrations. The former of the two shows "why a thing is", while the latter only "that a thing is." The former is called "a priori" demonstration because it starts with a cause which is prior to an effect, while the latter is an "*a posteriori*" demonstration because it starts with an effect which is naturally posterior to a cause. The "Propter quia" is more perfect than the "Quia" demonstration, because it leads to recognizing a thing via its cause, while the "Quia" demonstration leads only to recognizing the existence of a thing without indicating its cause. The two demonstrations do not differ by principles, both apply the same rules, premisses—first, true, direct, better known, prior to the conclusion, and causal toward it. In the "Propter quid" demonstration the direction of reasoning coincides with the direction of causal relationships, while in the "Quia" demonstration this direction is opposite to the direction of consequence, or the direction of causal relationships. There is no third intermediary kind of demonstration between these two. Unfortunately, Śmiglecki gives no examples for these scientific demonstrations. The distinctive demonstration may also use the definition of a thing. By definition one recognizes a thing in its essence and existence, its formal cause. Such a cause is required in every "Propter quid" demonstration. The form of demonstration may be circular in shape. By such a principle one demonstrates a conclusion and by this conclusion one then demonstrates the principle. According to Aristotle, such a "circle" in demonstration is unacceptable, because the same thing in it is simultaneously prior and posterior, a better and worse-known thing. Nonetheless, circular demonstration is frequent in science. In mathematics (geometry), from the equality of a triangle's sides one infers the equality of its angles, and conversely—from equality of angles follows equality of sides. This relation has in the theory of propositions its expression in the following implicative-equivalent thesis: C K p q C q p E p q. This example is a case of perfect circular demonstration. There is also imperfect circular demonstration, which is used when a causal proposition is not equivalent to a consecutive proposition: "Taking walks is the (effective) cause of one's health," and "One's health is the cause (purpose) of taking walks." Two different kinds of casuality occur in these: an effective (*efficiens*), and purposeful (*finalis*). No two-way implication holds between them. Aristotle excluded perfect and imperfect circular demonstration from the group of best, distinctive demonstrations. Śmiglecki does not know the pejorative expression "circulus vitiosus in probando."

7) In demonstration, one cannot go back indefinitely, se certain first and direct principles must be assumed. General demonstration should be regarded as more perfect than specific demonstration, because it gives us a general intellectual knowledge, which is of greater value than specific knowledge of sensory origin. Affirmative demonstration is more perfect than negative demonstration, because it requires no negative propositions to be put through. Negative demonstrations requires affirmative propositions, because negative propositions alone permit no proof of anything. Affirmative demonstration is more noble than negative demonstration. Śmiglecki gives no example of negative demonstration. Demonstration's result is knowledge, science (*scientia*). Science, or knowledge, is either partial, as the outcome of an appropriate partial demonstration, or total, as the accomplishment of many demonstrations and special studies in one kind of subjects of interest. By his nature, Man strives for cognition, knowledge, science; this striving is either inborn or acquired. His inborn striving makes Man tend to set off permanent cognitive psychophysical operations. His acquired striving is an act of a subject's acquisition of desired values. Things have two recognizable components: essence and property. The essence of things is recognized through definitions, while properties are recognized through demonstration. Perfect knowledge is either absolute (*scientia absoluta*) or relative (*scientia respectiva*). People have no absolutely perfect knowledge, whether by definition (*ex definitione*) or demonstrative (*ex demonstratione*); they do have relatively perfect knowledge when they know relatively well the causes of things. Intellectual knowledge depends on senses and derives from them, yet it cannot be acquired by senses alone. Knowledge refers to general things, while senses grasp only directly details, facts. Causal relationships between them are grasped by reason. Cognition refers to a certain set of terms and their referents, and is of compound propositional character. People think in propositions, and acquire knowledge in this way. Proposition comprises three components: subject, predicate and a conjunction between them. Cognition refers to the total of subject and predicate, is expressed in proposition having its substantial counterpart in reality.

8) The object of cognition is dual: 1^0 either reality taken in general, or 2^0 the same reality viewed from a special vantage point. The object of cognition, of science should exist of necessity. The first property of science is its truth, which has its foundation in actual existence of studied things. The second property of science is its connection with the principle of causality. The third property of science is its necessary character. Science cannot be referred to a fictitious reality which is presented by negative propositions, or to a reality not comprised by the principle of causality. Necessity is either absolute or conjectural, contingent. The concept of science comprises propositions expressing absolute necessity, but not propositions expressing conjectural reality. Practical and artistic activity is not the object of science. Practical science is not science in the proper sense. Speculative sciences alone represent proper knowledge because they refer to what by nature is the necessary object of its study. Science is a system of general, universal propositions.

Principles upon which science relies are eternal and invariable, and hence science too is permanent, eternal. Science can only be true. Truth is not science's essential perfectness, but only its essential property. As science's essential property, truth derives consequently from the essence of science and, in a specific manner, comprises this essence in itself. The essence of science is to explore reality through its causes. To put it more simply, true cognition is in accordance with the recognized reality. Such cognition is knowledge, science. Science is an ordered set of true propositions as elements of this set. The truth of propositions, which are elements of the set, cannot be applied to science as the set of these propositions. Paradoxically, science is a set of true propositions, but it is not true in the same sense as they are, because properties of the elements of the set cannot be taken to refer to the set itself. The set of true propositions connected by appropriate conjunctions represents a certain noncontradictory, and thus true, entirety. The truth of a set of propositions (of a science), its noncontradictoriness, is a consequence (*ex consequenti*) of the truth of its component propositions. In other words, the truth of science as a set of propositions is not an essential perfectness but only a consequent property, derivative from its property of noncontradictoriness. The truth of propositions which are elements of the set (science) is congruent, while the truth of this set as a whole is coherent. Element-propositions of the set are in accordance with reality (*congruentia*); science is a set of noncontradictory propositions (*coherentia*). Error, falseness are beyond science. It is evident (*evidentia*) as cognition deprived of certainty (*certitudo*). Science is a certain intellectual reality. Its essential principles exist only in reason (*principia intellectualia*). Disposition to scientific knowledge may coexist with disposition to err slightly, but disposition to scientific knowledge cannot coexist with current error in science. Whoever acquired scientific knowledge cannot commit an error contrary to it.

9) On account of its certainty science opposes opinion, belief. Science is certain and permanent, while opinion does not have these properties. The mental act of opinion cannot coexist with an act of scientific knowledge. Opinion is created by nonnecessary, probable knowledge. The self-evidence of the truth of propositions is dual: it is self-evidence by consequence (*evidentia consequentiae*) and self-evidence by conclusion (*evidentia consequentis*). The former is expressed in the "Dici de omni..." and the "Dici de nullo..." rules of inference. These two are the most self-evident of all logical rules. It is on them that all syllogisms of Aristotle's three figures rely. In mathematical demonstrations, the self-evidence of coupling of a consequent (*consequens*) to its cause or reason (*antecedens*) alone suffices to infer the self-evidence of the effect, of the conclusion, regardless of other circumstances of demonstration. Briefly, if C p q, and p, then q. To build a system of perfect science (*scientia perfecta*) it is necessary to apply the rule of self-evidence of consequence (*ev. consequentiae*), or the rule of all Aristotelian syllogisms of figures I, II and III. Śmiglecki does not mention the Peripatetic figure IV, although he applies it in exemplifications of some of his logical considerations. The rule of self-evidence of conclusion (*evidentia*

consequentis) need not absolutely be applied in building knowledge, unless a system of perfect science were at stake. For the self-evidence of the truth of conclusion is required the self-evidence of truth of both premisses. Briefly, *evidentia consequentiae* indicates a correct syllogistic structure, while evidentia consequentis indicates a true conclusion from true premisses. From non-selfevident premisses follows a non-selfevident conclusion.

10) As regards intellectual and volitional processes, there are certain psychological qualities called *habitus*- dispositions, propensities, abilities. According to some logicians, disposition to knowledge is ability to order notions as intellectual forms of cognition. According to others, disposition to knowledge is an ability to draw specific illative judgements which manifests itself in the act of judgement itself. According to a third group of logicians, disposition to knowledge is a permanent and conscious propensity to perform cognitive acts. According to a fourth group (St. Thomas Aquinas), disposition to knowledge enables reason to carry out quick and free acts of scientific knowledge. Aristotle mentions five intellectual dispositions: 1^0 a disposition to grasp principles (*intellectus*), 2^0 a disposition to knowledge, science (*scientia*), 3^0 disposition to wisdom (*sapientia*), 4^0 disposition to prudence (*prudentia*), and 5^0 disposition to artistic creation, to the arts (*ars*). Dispositions to logic, to morality or to free professions are not mentioned. Intellectual disposition is either theoretical (*speculativa*) or practical (*practica*). Theoretical disposition refers to conclusions or to premisses, principles. When it refers to conclusion, it is scientific knowledge (*scientia*). When it refers to principles, premisses, then it is reason (*intellectus*). When it refers to both simultaneously, then it is wisdom (*sapientia*). Practical disposition is active and is called prudence (*prudentia*), or it is productive and is called art (*ars*). Śmiglecki describes in a quasi-definitional form the following five dispositions: 1^0 Reason (*intellectus*) is a disposition to grasp principles on the basis of direct self-evidence of meanings of its constituent terms. 2^0 Knowledge (*scientia*) is a disposition to grasp conclusions alone. 3^0 Wisdom (*sapientia*) is a disposition to recognize conclusions in the most general light, ultimate principles. 4^0 Prudence (*prudentia*) is a disposition to manage actions designed to afford decent good (*bonum honestum*). 5^0 Art (*ars*) is a disposition to manage creation, which materializes in beauriful works. The (seven) free professions involve a disposition to action rather than to creation. The Aristotelian dispositions are not instrumental in character; they are self-dependent and autonomus with regard to others. Disposition to logic does not belong to them because logic is instrumental in character and is neither a speculative nor a practical discipline.

11) Total, or integrated science (*scientia totalis*) is a set of many specific research disciplines which (as its parts) refer to the same kind of objects and principles. They have a common material object but different formal objects. Total science is a unified science. Its ordered unity resembles the unity of an army, which is composed of many soldiers (many branches of military service) and yet, because of its internal specific internal order is a unified armed force. Similarly, the many par-

ticular, special disciplines which are ordered with one another, constitute a unified total science. It is unified both in the collective sense (one kind of principles, one proper degree of abstraction, one kind of studied objects) and in the aggregative sense (integration of disciplines differing by their formal objects into one ordered whole). There are three degrees of abstraction: physical, mathematical, metaphysical. Physical abstraction disregards what is specific in material objects while grasping their material nature, their quality. It is applied in physics. Mathematical abstracion disregards the nature of material objects while grasping their perceptible, quantitative form. It is applied in mathematics. Finally, there is metaphysical abstraction, which disregards both the substance and the form of studied objects while grasping their being, their existence. It is applied in metaphysics. Thus differentiated, abstraction furnishes no foundation for building any unified, supreme total science. Total science is not universal science, which embraced all academic disciplines of the time such as philosophy, theology, law, mathematics, physics with astronomy, and medicine; it is a science coalesced from many disciplines having a common material object but different formal objects and a common degree of abstraction. Total science, as presented by Śmiglecki, has its present-day counterparts in designations of university chairs and faculties. His concept of *scientiae totalis* can be classed with ideas such as the *Ars magna* of Raimundus Lullus (13th–14th century) or Leibniz's *Mathesis universalis* (17th-18th century).

12) Practice (*praxis*) is activity guided by indications of reason. It derives from reason as the ordering factor and from will as an executive factor. The notion of practice embraces two abilities: artistic and moral. Practical cognition differes from theoretical, or speculative cognition by its purpose. The purpose of practical cognition is craftsmanship and efficient external action, which is connected with its origin; the purpose of theoretical cognition is truth. Moral science is, formally, a practical discipline. In between speculative and practical cogniton there is instru mental cognition, namely logical cognition. This is instrumental because, while guiding speculative and practical cognition alike, it is neither. Rather remarkably Śmiglecki inserts a passage on efficient practical action in his *Logic*. Praxis is co n nected with logic as a guiding factor in action. Thus outlined, the topic of praxi- will be broadly elaborated only in the 20th century under the heading of praxiology, when it takes the form of a logical theory of efficient action officially included in university curricula.

13) Definition, its varienties, boundaries and significance in science. Definition is a statement explaining the essence of a thing. Definition itself cannot be defined, because this would necessitate definitions to infinity. Definition may be understood either formally or materially. Its formality manifests itself in its structure and refers to the defined notion, say Man, which means as much as rational animal. The materiality of definition is expressed in its realism, material reference, and it concerns the defined thing, say Man, which is a rational animal. Definitions are either objective or formal. Objective definition refers to a thing corresponding to a formal

notion. Formal definition is an act of intellect referring to the notion, to the meaning of a term. Śmiglecki regards material and objective definitions as real definitions, while formal definitions are nominal definitions. Definition cannot be regarded as one term. Definition (*as definiens*) is an expression different from the *definiendum*, that is, from the designation of the defined thing (*definitum*). By its nature, definitions (*as definiens*) is clearer than the definiendum (*definitum*); of necessity it should be composed of a generic term and a specific difference. Definition cannot emerge from a term of highest genus and from a difference of lowest genus, because intermediate genera or specific differences do not occur in such a definition. Definition by a term of lowest genus and the last specific difference is correct, because the lowest genus embraces all higher genera and their specific differences. Although the essence of a thing naturally differs from that of which it is the essence, an essential definition does not naturally differ from a corresponding defined thing; definitions and their objects are as if "clusters", ontological coalescences. Definition and defined object should be mutually interchangeable. Negations cannot be defined because they do not refer to the essence of a thing, there is nothing to explain in them. Similarly, fictitious beings cannot be defined because they either lack properties necessary to formulate the defining member (say, *Essentia*) or are universal terms having no superior genus above them or a closest specific difference (say, *Ens*). Nor can analogous notions be defined; but univocal terms are definable. Definitions are descriptions of genera. Individuals do not contain a new degree of essence which would differ from generic essence and hence they can have no definition different from the genus of the definition. One thing may have many essential definitions (say, a square), but in fact there is only one proper essential definition for it, namely the shortest one, as there is only one essence proper for a thing. Sometimes the essence of a thing is defined by means of different terms and hence there are different essential definitions. There may be metaphysical, physical, logical and mathematical definitions. A metaphysician uses terms to define notions of potence and act; a physicist by means of qualitative material terms; a logician by means of generic terms and specific differences; finally, a mathematician by means of quantitative terms. Śmiglecki gives no examples of quantitative terms. The defining member (the *definiens*) is closely pertains to the defined member (the *definiendum*) that it is impossible for the thing to be otherwise; so, definition is of necessary character. Definitions of artistic, utilitarian objects or of craftsmen's products are not necessary in character, and therefore are not classed within the notion of science.

V. CONCLUSION

The concluding pages of the *Organon Logic* are devoted to considerations of what is more dignified, the validity of definition or that of scientific demonstration? This is an example of an emotional projection of the contemporary hierarchical ladder in state organization on the value of various levels of components of science.

Which is more dignified, more noble in science — definition or demonstration? After a lengthy passage of intricate inquiries Śmiglecki concludes that definitional knowledge is more noble than demonstrable knowledge. Definition is more noble than demonstration, just as His Majesty the King is more noble than the magnate Zamojski. This much about Śmiglecki's considerations of the third level of rational operations.

Habent sua fata libelli. The *Organon Logic*, too, had its vicissitudes. Written in the international language of sience, known and appreciated in the West, it sunk, after having made a "career" in England, into oblivion. Today, *nec quidem verbo memorata est* in the extensive histories of logic by Bocheński, *Formale Logik* (1956) and *A History of Formal Logic* (1961), by Kotarbiński, *Leçons sur l'histoire de la logique* (1965), and by W. and M. Kneale, The Development of Logic (1978).