

THE ROLE OF SYSTEMATIC TOTALITIES IN DESCARTES' *REGULAE AD DIRECTIONEM INGENII*

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Abstract. Descartes' *Regulae* is a puzzling text. His rules for directing knowledge seem to recommend either obvious or unattainable steps for the scientist in search of knowledge. My claim is that the *Regulae* make more sense if one interprets them as giving guidelines for systematization of knowledge, specifically for constructing the edifice of knowledge in the shape of what today we would call an *axiomatic system*.

Keywords: Descartes, rules, science, knowledge, system

1. THE QUESTION

Descartes' *Regulae* seems to have a peculiar position: it is supposed to be a work of major importance, but the reason for being so eludes us. The cornerstone position is assigned to it not only by Descartes scholars laboring over its role and significance within Descartes' famous philosophical method, but by Descartes himself: it is supposed to be the battle cry against the sterile teachings of the Schools and against the fumbling of his contemporaries when dealing with science; even more, it is supposed to be the best instrument humans ever had for the advancement of knowledge:

Therefore, since the utility of this method is so great that, without it, the pursuit of learning would seem to be more harmful than helpful, I am easily persuaded that those of greater natural intelligence have already seen it in some manner (...) For this discipline should contain the primary rudiments of human reason, and it should extend to truths to be elicited in any subject whatever. And frankly speaking, I am convinced that it is more important than any other knowledge handed down to us in human fashion, since it is the source of all the rest¹.

But the verdicts against it are harsh: first, it is unfinished, which is supposed to be a convincing enough argument about Descartes' own doubts regarding its

¹ Descartes, *Regulae ad directionem ingenii – Rules for the direction of natural intelligence* (bilingual ed.), transl. G. Heffernan, Amsterdam & Atlanta, Rodopi, 1998, pp. 88–9.

feasibility. Second, scholars like Daniel Garber famously complain that it is a strikingly unmethodical and „disorderly” work, as the rules themselves do not seem to obey any particular method of exposition. And third, Leibniz’ discontent seems to be the one echoed by every first encounter with the text of the *Regulae*, namely that:

[...] the method may seem to contain but the bare outlines of words of sound advice on the necessity of thinking clearly, avoiding precipitancy in our judgments, and setting our ideas out in their proper logical order. Inevitably the complaints of Leibniz occur: ‘I almost feel like saying that the Cartesian rules are rather like those of some chemist or other: take what is necessary, do as you ought to do, and you will get what you wanted. Do not admit anything except what is evidently true (in other words, except what you ought to admit), divide the matter into as many parts as is requisite (that is as many as you ought to), proceed in order (in which you ought to proceed) and make perfect enumeration (as you ought to)’².

It is noticeable that Leibniz’ complaint is carefully worded: „I almost feel” is not the same as „it is obvious that”. We certainly feel that there is something prosaic about these rules and, in this sense, also vacuous: they are so general, almost any way of going about thinking seems to fit. And, in a sense, this might be regarded as straightforwardly correct. But again, we must have an „almost” here. The point I will try to raise is that there is another side of Descartes’ rules, one I will try to underline and defend as anything but dull. It is only a trait, a fragment of his project but it is, I believe, one of the things that make us cautious when speaking about the flatness of Descartes’ rules, namely his insistence on *systematic totalities*. The main question, therefore, (for which I will try to provide an answer) is the following: how can we explain Descartes’ repeated claim that in order to have a fully-fledged, mature, useful method of acquiring knowledge/science³ we have to make sure not only that we do not take into account falsities instead of truths, but also that we take into account *all* the truths?

Several caveats are in order: I am not going to provide an answer for the mystery of Descartes’ unfinished *Regulae* – why did he write it, what was their intended role, whether he abandoned his project or not. Also, I am not going to give an account about how Descartes’ various tenets about science may form a coherent picture - this is another important and widely discussed topic. All I will try to do is to show that there is an unusual and revealing requirement among the banal requirements of the *Regulae* and that the unusual requirement points towards an ideal of systematicity. As I said above – how this ideal fits with the whole picture of Descartes’ position on science, if there is one coherent Cartesian position and if he abandoned or not whatever project he was proposing in the *Regulae* – it will be left out of the present discussion.

² Beck, L.J., *The Method of Descartes*, Oxford, Clarendon, 1952, p. 286.

³ The ambivalence of the term will be discussed below.

Nor will I take a position regarding the overall purpose of the *Regulae*: if it is about knowledge (i.e. it presents the „natural logic under the guidance of which Descartes’ whole thought lived and moved”⁴) or science (i.e. to serve as an instrument because „Descartes’ principal project was to build a science of nature about which he could have absolute certainty.”⁵) or both. Interestingly enough, the translation I will employ in my present research, namely George Heffernan’s translation, dangerously translates the Latin „*scientia*” sometimes as „science” and sometimes as „knowledge”, which at times makes the two perspectives even harder to distinguish. I think that the thesis I will try to defend does not rest on this distinction, but I will signal the Latin term each time it appears translated as something else than „science”.

2. THE TEXT OF THE *REGULAE*

I will start with an observation useful as a background for the problem: the text itself of the *Regulae*, at least for the first group of twelve rules, might be seen as not so „unmethodical and disorderly” as Garber presents it.

For example, the first three rules may be seen as answering in a very reasonable order to quite reasonable questions. One might say that the first rule establishes *the goal* of the enterprise (answering to a „why” type of question), the second rule establishes *the object* of the enterprise (answering to a „apply to what” type of question) and the third rule establishes *the way in which* we are supposed to perform the action (answering to a „how” type of question). Or, for any proposed enterprise it is reasonable to ask to be informed why, applied to what and how one is supposed to proceed. If we look at the details of this picture, Rule One states that „The goal of studies should be the direction of the natural intelligence toward the formation of solid and true judgments about all the things that occur to it.”

Even though the goal is clearly stated, the action is still open to interpretation: are these supposed to be „studies” in the sense of scientific research or are they to be understood in a more comprehensive manner, like „any regular exercise of intelligence”? Are they, the studies, for everyone or only for specialists? To whom exactly is the advice addressed? For the purpose of the present research, the above questions may be left aside. But there is one aspect that must be underlined, namely the last bit of the phrase establishing that the domain for the exercise of natural intelligence in forming solid and true judgments is the domain of *all things that occur in it*. Of course, we might interpret this as saying that it is desirable that the natural intelligence form solid and true judgments about *each* object of its application or about *all* of them (as a group). However, Descartes’ point seems to be here (if we take into account the subsequent comments to Rule One) the unity of the human

⁴ Gibson, B., *The Regulae of Descartes*, “Mind”, 7 (26), 1898, p. 149

⁵ Garber, D., *Science and Certainty in Descartes*, in V. Chappell (ed.), *Essays on Modern Philosophers*, New York & London, Garland Publishing, 1992, p. 284.

faculty of intelligence in its multiple usages. Unlike the arts, Descartes claims, science does not need a special skill for each of its objects but one skill, one way of operating for any kind of object. Therefore, it would be reasonable to try to establish (or, more accurately to find, to discover) the one and only method naturally employed by the natural intelligence. In these circumstances, the question about which is the domain over which the natural intelligence is applied comes naturally: there is one faculty scrutinizing a domain - which one? And this is the point of Rule Two: „We should attend only to those objects for who’s certain and indubitable cognition our natural intelligence seems to suffice.” The rule obviously aims at limiting the domain, but how do we know that we have reached „certain and indubitable cognition”? When we had „clearly and evidently intuit or certainly deduce” tells Rule Three:

Concerning proposed objects, one has to investigate, not what others may have felt or what we ourselves shall conjecture, but what we can clearly and evidently intuit or certainly deduce – for knowledge [Lat. *Scientia*] is acquired in no other way⁶.

Of course, this is not to say that it is obvious what it means to „clearly and evidently intuit” something, but at least there is a reasonable connection between what the rules are saying so far. But given that we are speaking about natural intelligence, everyone is able to intuit and deduce things and ordinarily we do. Descartes’ further recommendation embodied in Rule Four will be that these natural operations have to be applied *methodically*: „A method is necessary for investigating the truth of things.” Depending upon the interpretation adopted, the Cartesian method may consist in deducing truths *more geometrico* (the traditional view according to Garber, 1992) or in acquiring certain mental skills (according to Gibson, 1898) or in training your mind to intuit the truth (according to Gibson, 1898). I will come back to this important point. For the time being it might be important to notice that the following three rules are just giving details about the prescribed method. Rule Five tells that „The whole method consists in the order and arrangement of things” and that we should „reduce complicated and obscure propositions to simpler ones, and then we try to ascend, through the same steps, from the intuition of the simplest ones of all, to knowledge of all the others.” But how are we going to reduce the complicated to simple if we do not know which is which? Rule Six comes with advice about that:

In order to distinguish the simplest things from the complicated ones and to pursue the former in an orderly manner, we should observe, in each and every series of things in which we have directly deduced some truths from others, which is the most simple and how all the others are more or less equally removed from it⁷.

⁶ R. Descartes, *Regulae ad directionem ingenii – Rules for the direction of natural intelligence* (bilingual ed.), transl. G. Heffernan, Amsterdam & Atlanta, Rodopi, 1998, p. 110

⁷ *Ibidem*, p. 111.

After establishing the series of ordered objects of contemplation, then our operation must be of a certain kind, namely continuous, uninterrupted movement of thought comprising all the objects of our inquiry (an indication pertaining, again, to explanations about the prescribed method and present in Rule Seven):

For the completion of knowledge, we should survey, in a continuous and completely uninterrupted movement of thought, all the things that relate to our project, together and individually, and we should also summarize them in a sufficient and orderly enumeration.⁸

Descartes speaks about Rule Eight as if from another kind than the preceding three ones („The three preceding rules prescribe and explain order; the present one, on the other hand, shows when order is completely necessary, and when it is merely useful”⁹), but it is obviously another specification of the method, namely about the limits that we should set to our inquiries:

For someone who, in the solution of a difficulty, has exactly observed the previous rules, but who will still be ordered by the present one to stop somewhere, will then know for certain that one cannot, by means of any amount of industry, find the knowledge sought, and this, because it is not a defect of the natural intelligence, but the nature of the difficulty itself or the human condition, which presents the obstacle to doing so. This recognition is no less knowledge than that which reveals the nature of the thing itself; and one would not seem of sound mind if one were to extend one’s curiosity any further¹⁰.

It is after this rule that a different kind of rules appears, as Descartes himself explains in the first paragraph of Rule Nine:

Having now provided an exposition of the two operations of our intellect, intuition and deduction, which alone, as we have said are to be employed in the acquisition of knowledge, we proceed, in this and the following proposition, to explain by means of what industry we can render ourselves more apt at exercising these operations [...]”¹¹.

Consequently, rules from nine to twelve will be concerned with recommendations regarding this kind of „exercises” for the natural intelligence. From the above presented point of view, a summary of the rules up to this point does not present us with a chaotic picture. One is given a purpose of investigation, a domain of investigation and a manner of investigation: by methodically applying deduction and intuition. Then „methodically” is detailed and rules are given for ordering objects (dividing them in simple and complex) and employing faculties in a certain manner (uninterrupted movement of thought and acceptance of limits). It

⁸ *Ibidem*, p. 112.

⁹ *Ibidem*, p. 113.

¹⁰ *Ibidem*, p.115.

¹¹ *Ibidem*, p. 123.

is true that this relatively ordered picture is obtain if we do not take into account the question if the aim of the enterprise is actually accomplished and we just take into account the declared intentions of the author. It is also true that not all rules are of the same type in the sense that some are just explanations for others and maybe today we would subsume them under one main heading. But they might be regarded, I think, as answering to distinct and nevertheless logically related questions.

3. THE PROBLEM

Within this structure of *Regulae*, the problem to be discussed focuses on claims that are clearly present in Rule Five and Rule Seven, but not only there. The puzzling feature I want to discuss may be found scattered all over the text of *Regulae* and has some corresponding occurrences in the *Discourse*, too. I am speaking about what I will call *Descartes' insistence on totalities*.

Rule Five states, to repeat:

The whole method consists in the order and arrangement of things on which the vision of the mind has to be focused in order that we might discover any truth. And yet we shall be following this method exactly if, step by step, we reduce complicated and obscure propositions to simpler ones, and then we try to ascend, through the same steps, from the intuition of the simplest ones of all, [my emphasis] *to a knowledge of all the others*¹².

Most probably, „all the others” here is not meant to refer to all knowledge, but only to the afore mentioned complicated propositions (as we start back from the simple ones), even though there is a suggestion earlier about discovering „any truth”. The case seems to be the same for Rule Six which states:

In order to distinguish the simplest things from the complicated ones and to pursue the former in an orderly manner, we should observe, in each and every series of things in which we have directly deduced some truths from others, which is the most simple and how *all the others* are more or less equally removed from it¹³.

Again, one does not assume that this is about the totality of knowledge, but it is a totality Descartes is speaking about, namely the totality of logically related truths. It seems to be the same worry in Rule Seven which speaks about the „completion of knowledge”:

For the completion of knowledge [Lat. scientia], we should survey, in a continuous and completely uninterrupted movement of thought,[my emphasis]

¹² *Ibidem*, p.111.

¹³ *Ibidem*, p. 111.

all the things that relate to our project, together and individually, and we should also summarize them in a sufficient and orderly enumeration¹⁴.

Here the rule speaks about all the things that relate to a certain project but also about completing science as such. The above quoted rules do not seem to have as their concern the totality of human knowledge, but one might find in *Regulae* passages that might be interpreted as referring at the whole of knowledge:

For this discipline should contain the primary rudiments of human reason, and it should extend to truths to be elicited in any subject whatever. And frankly speaking, I am convinced that it is more important than any other knowledge handed down to us in human fashion, since it is [my emphasis] *the source of all the rest*¹⁵.

Also Rule One itself proclaims that the goal of studies should be the directing of the natural intelligence such that it would arrive at true judgments about „all the things that occur to it”. As previously noted, this might mean each and every thing or all of them. The sweeping air of universality seems to appear also in the rules formulated in the *Discourse*, where nothing that could be doubted should be allowed and moreover:

And the last was everywhere to make enumerations so complete and review so general that I were assured of omitting nothing¹⁶.

The above quote may be interpreted as saying „omitting nothing important or relevant for solving a problem” or as saying in full generality „omitting nothing from what I may know” or, even more general „omitting nothing from what it is possible to be known to anyone”. We might, therefore, take into consideration different kinds of totalities: the absolute totality of human knowledge as such, or the relative, partial totalities of what a certain person may know, or the totality of truths relevant for a given problem in a given circumstance. It is not the case that „partial totalities” cannot be considered „totalities” anymore because Descartes never speaks about accumulations of disparate truths in mere heaps (unless he wants to criticize that). What he considers desirable is the deductive linkage of truths, i.e. a system – and this is why in *Regulae* he speaks about the metaphor of a chain. A system may well be described as a relative or partial totality because it is able to maintain its unity in virtue of its structured parts.

Of course, there is nothing new in the idea that Descartes was, at least at a certain point, a supporter of the idea of one, unified, universal, systematic science, in the form of the famous tree of knowledge, as Clarke describes:

¹⁴ *Ibidem*, p.112.

¹⁵ *Ibidem*, pp. 88–9.

¹⁶ R. Descartes, *Discourse on the Method of Rightly Conducting One's Reason and Seeking the Truth in the Sciences*, J. Cottingham, R. Stoothoff & D. Murdoch (transl.), *Selected Philosophical Writings*, Cambridge, Cambridge University Press, 1988, p. 21.

In the *Preface* to the French edition of the *Principles*, Descartes introduces a metaphor that accurately expresses his views about the relationship of physics to metaphysics. "Thus the whole of philosophy is like a tree. The roots are metaphysics, the trunk is physics, and the branches emerging from the trunk are all the other sciences, which may be reduced to three principal ones, namely medicine, mechanics and morals"(...) There was nothing unusual in this suggestion. Descartes had maintained for about twenty-five years prior to this that physics, as he understood it, is based on or depends on metaphysics and that any natural philosopher worth his salt had better get his metaphysics in order first, before tackling the explanation of specific natural phenomena¹⁷.

Commentators have pointed out first, that this is a tradition Descartes inherited from medieval times and second, that this conception of science would unify disciplines that have very different epistemological statuses, like metaphysics and physics. And that while hypothesis and experiment are the requirements of physics, they hardly get along with the a priori certain character required by a system of deduction of truths like the one presented above. Even if we leave aside as extravagances such images of the tree of knowledge, there might be still a tension between the systemic character required by the deduction and intuition on the one hand and the problem-solving experimental approach on the other hand. Daniel Garber has such an approach when noticing that, indeed, for the Descartes we witness in *Regulae*, all knowledge seems to be interconnected in a system and our main task is, therefore, „constructing the complete system of knowledge”. But this is contrasted with another Cartesian desideratum, namely the piecemeal solving of actual problems:

But as I noted earlier in discussing the method of the *Regulae*, the method presupposes a certain conception of the structure of knowledge. All knowledge, for Descartes, is interconnected, grounded ultimately in a small number of intuitively knowable propositions from which all else follows deductively. (...) It is precisely because all knowledge is interconnected in this way that the method is possible, that it is possible to take a question and reduce it to an intuition from which an answer could be deduced. But this very doctrine that makes the method possible leads to its demise. For if all knowledge is interconnected, then what we should be doing is not solving individual problems, but constructing the complete system of knowledge, the interconnected body of knowledge that starts from intuition and comes to encompass everything capable of being known. (...) Unlike others, Galileo, for example (cf. AT II 380), Descartes' strategy is to start not with individual questions, but to start at the beginning, with the intuitively graspable first principles that ground the rest, and progress step by step from there downward to more particular matters. No longer a mere problem solver, Descartes has become a system-builder.

¹⁷ D. Clarke, *Descartes' philosophy of science and the scientific revolution*, in J. Cottingham (ed.), *The Cambridge Companion to Descartes*, Cambridge, Cambridge University Press, 1992, p. 271.

But as a system-builder, what role can there be for a method whose goal is the solution of individual problems?¹⁸

Garber's verdict both here and in his article „Science and Certainty in Descartes” is that Descartes abandons his project of systematic science from *Regulae*. If one agrees or not with this thesis, it is irrelevant to the point I am trying to make, namely that Descartes' insistence on totalities is first, a feature that makes his rules and his method quite unusual and second, that it is a feature pointing towards the desirability of systematicity.

I will argue in the next section for each of these tenets.

4. DESCARTES' IDEAL OF SYSTEMATIC KNOWLEDGE

My first tenet is directed against the usual first impression that Descartes' rules do not say anything out of the ordinary, other than any indications of common sense when faced with an intellectual task. There is no need to invoke here grand images of the whole unified science. It is enough to take totalities in their partial, relative sense, namely as „all that is relevant for us in solving a certain problem”. I believe that when we say „all that is relevant” we are already making a selection which is *not* the partial totality Descartes would recommend. For let us remind Leibniz' critical rendering of what Descartes supposedly does in *Regulae*: „Do not admit anything except what is evidently true (in other words, except what you ought to admit), divide the matter into as many parts as is requisite (that is as many as you ought to), proceed in order (in which you ought to proceed) and make perfect enumeration (as you ought to).” The first two requirements are perfectly ordinary: accept only truth and divide matters into simpler ones. But the third, on a closer look, seems enormous, impossible, and absurd: who can make a *perfect* enumeration, as required by Rule Seven of *Regulae* and the fourth rule from the *Discourse*? Who can make, for each intellectual task, a *perfect* enumeration of all that is relevant for that task? And I admit here „all that is relevant”, not „all the truths that are logically connected with the truths relevant to the task” as most probably the Cartesian rule would have sounded. This recommendation seems to be an utopian recommendation, which cannot be taken seriously. However, there is another possible perspective which makes the Cartesian requirement both reasonable and valuable: *it makes sense as an ideal of the systematization of knowledge*. And it does make sense even if there is no project of one single universal edifice of the whole science, but it is relativized to disciplines and branches. And this leads to the second tenet to be supported here.

My second tenet is that Descartes insistence on totalities might be plausibly interpreted as indicating a preference for systematicity and moreover the incipient *idea of the utility and desirability of something resembling an axiomatic system*.

¹⁸ D. Garber, *Descartes and Method in 1637*, in *PSA 1988: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, 1989, p. 233.

Descartes has in *Regulae* all the main elements constituting basic, primitive requirements of an axiomatic system, even though they are all embedded in an unfamiliar language for what we call today „an axiomatic system”: there are certain starting points of the deduction chains (the simple, obvious truths of the natural light secured in their certainty by intuition), there are deduction chains (which preserve the truth and the certainty of intuitions) and there is the requirement similar to a „no gaps” rule (the chain of deduction is supposed to not tolerate any interruption). What his edifice in *Regulae* does not have, and it cannot escape observation, is specific deduction rules, which indeed makes the whole enterprise seem unsubstantial:

Now the exposition of the method of the *Regulae* is oriented on – but not to be identified with – the effort at an extension of geometrical algebra into a mathesis universalis. For the main aim is the attempt at a realization of the ideal of a universal mathematics capable of dealing specifically with all those aspects of its objects which can be ordered and measured independently of any particular material features; thus the first and foremost objects of this discipline turn out to be relations and proportions, not only between numbers, figures et cetera, but also between stars, sounds, et cetera. (...) Unfortunately, however, beyond the vaguely ‘mathematical’ character of the method set forth at the conference, there is little extant information on its content.¹⁹

As stated in the above quote, the method in *Regulae* also has another feature acting as an irresistible clue towards formal systems for today’s philosophers: it is supposed to be „topic neutral” in the same way Logic is said to be. According to Beck, there are other affinities, too:

Given the Cartesian predilection for the mathematical sciences, and above all the aim set in the *Regulae* and carried out in practice in the Geometry, the ideal, i.e. the reduction of a problem by analysis and its synthetic construction in accordance with a constitutive equation, it would not be astonishing to find in his ‘logic’ some sympathy with a mathematical logic similar in spirit to the later developments of, for instance, Leibniz, Jevons, or Russell.²⁰

But this observation is immediately met by Beck himself with the observation that Descartes could not have agreed with the idea of a system of logic as his method. First, because syllogistic was in his eyes useless and, second, because his method was supposed to a method that engenders truth and logic has no such means or purposes:

As we have seen, Descartes maintains that whereas earlier mathematicians were exclusively concerned with computing particular numerical solutions to

¹⁹ This is George Heffernan’s comment in the Preface of his translation; R. Descartes, *Regulae ad directionem ingenii – Rules for the direction of natural intelligence* (bilingual ed.), transl. G. Heffernan, Amsterdam & Atlanta, Rodopi, 1998, p. 9.

²⁰ L. J. Beck, *The Method of Descartes*, Oxford, Clarendon, 1952, p. 274.

equations, he abstracts from numbers because he is concerned with structural features of the equations themselves. Now it is possible to draw a direct analogy with logic here. If we are to think of logic in algebraic terms, in the same way that Descartes thinks of arithmetic algebraically, what we must do is abstract from particular truths (just as Descartes abstracts from particular numbers) and explore the relations between truths, independently of their content, in abstract structural terms. But this move to a higher level of abstraction, which Leibniz glimpsed, and which is constitutive of modern logic and the philosophy of mathematics was utterly alien to Descartes. Descartes was blind to the possibility of logic being construed in terms of an extension of his algebraic techniques because he conceived logic (which for him was Aristotelian syllogistic) as being a redundant method of presentation of already achieved results, whereas algebra, he thought, was something completely different, namely a method of discovery of new results²¹.

I have no intention to contradict these observations, even though I claim that Descartes insistence on totalities is pointing at something like the desirability of a system similar to an axiomatic system. First, the systematicity I am speaking about is not as definite as a discipline, like logic; it is more like a strive, a tendency towards a general systematic approach for which logic has become today paradigmatic (much in the same way mathematics was exemplary in Descartes' time: saying that what he wanted to build was not mathematics but „like mathematics” is very similar to my way of saying that his systematicity was not exactly logic but „like logic” today). Moreover, I think that the role played by Descartes' insistence on totalities is very similar to the role played by the requirement of completeness in an axiomatic system. Descartes has ways of expression in *Regulae* that come very close to the usual requirements from an axiomatic system: that all the provable formulae are true (i.e. there should be no falsities in the system) and that all the truths the system can express are provable in the system (i.e. there should be no truths outside the system: the system is complete):

By a method, moreover, I understand certain and easy rules – rules such that, if one has followed them exactly, then one will never suppose anything false to be true [...] but will always gradually increasing knowledge [Lat. *Scientiam*], one will arrive at the true knowledge of all those things of which one will be capable.

But here one has to note two things, namely that one is, of course, to suppose nothing false to be true, and that one has to arrive at a knowledge of all things (*ad omnium cognitionem pervenire*)²².

²¹ Stephen Gaukroger, *The nature of abstract reasoning: philosophical aspects of Descartes' work in algebra*, in J. Cottingham (ed.), *The Cambridge Companion to Descartes* (pp. 91–114), Cambridge, Cambridge University Press, p. 105.

²² Descartes, *Regulae ad directionem ingenii – Rules for the direction of natural intelligence*, p. 85.

I think that Descartes' insistence on totalities had this role, too, of ensuring that science has the requirement that any truth concerning a discipline is an 'inside' truth of the system of that discipline, i.e. it can be logically obtained from the basic assumptions of the discipline (i.e. Descartes' „simple things”). After all, one of the main differences between what Descartes wanted to do in science and the much criticized and ridiculed approach of his contemporaries to science does not consist in the fact that Descartes' contemporaries could not find various truths about nature. Descartes himself admitted that they did. The problem for him was the unsystematic haphazard fashion in which these truths were obtained, i.e. the lack of logical connection between various fragments of truths: they did not form logical totalities and the truths popping up here and there could not be established as being „inside” or „outside” any discipline. This is, of course, because the inside or outside of any systematic enterprise on the axiomatic model is established by the relation with its primary truths.

To conclude, the interpretation that I propose in order to make better sense of Descartes' *Regulae*, is that they betray an ideal of systematic knowledge, where the system has many recognizable traits of what we call today an „axiomatic system”. This is not by any measure surprising. Learned scientists of modern times were very familiar with a celebrated instance of an axiomatic system, namely with Euclid's geometry. It is quite plausible that the ideal of an organized body of knowledge or systematic knowledge be thought to follow that model (and, maybe, to add to it).

My claim is that the traits making Descartes' *Regulae* similar to the structure of an axiomatic system are the following:

- a) The requirement of a perfect enumeration of all truths – which is a requirement similar to our contemporary requirement that the system has to be complete. (Rule One, Rule Seven)
- b) The requirement that the system of knowledge has to have starting points – similar to axioms – which are the simple, obvious truths secured by the „natural light”, so that they do not need proof or further justification (i.e. obvious truths) (Rule Three, Rule Five)
- c) The requirement that the system of knowledge has to have deduction rules – in order to preserve the truth for what we deduce from axioms. (Rule Six, Rule Seven)
- d) The requirement that the system of knowledge has to have „no gaps” in the chain of deductions from axioms. (Rule Six)

I believe that, regarded this way, Descartes' text in *Regulae* makes more sense and escapes the initial impression of useless obviousness.