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From Universal Mathematics to Universal Method: Descartes's "Turn" in Rule IV of the *Regulae*

PAMELA A. KRAUS

I. THE QUESTION OF THE *REGULAE*

DESCARTES'S FIRST PHILOSOPHICAL TEXT, *Regulae ad directionem ingenii,*[1] is also the first formulation of his notion that philosophizing must begin by elaboration of the true method. Many scholars, however, have regarded the *Discours de la méthode* as the primary text for the study of Cartesian method. The *Discours,* unlike the *Regulae,* is a complete and published writing, and its succinct statement of the "four rules of method" has attained something of a canonical status. Yet the *Discours* is clearly a popular writing, intended as an introduction to the appended scientific *Essais;*[2] and its individual rules are

[1] The importance of the text was immediately recognized by seventeenth century thinkers. Baillet calls it a model for "an excellent logic," Adrien Baillet, *La vie de Monsieur Descartes* (Paris: 1691), T. I, p. 282. Parts of Rules XIII and XIV were used for the second edition of the Port Royal Logic, Antoine Arnauld and Charles Savreux (1664). Leibniz procured and annotated his own copy. Leibniz's manuscript was found during the later half of the nineteenth century and was published in *Oeuvres inedités de Descartes,* ed. M. Le Cte. Foucher de Careil (Paris: A. Durand, 1859–60). The appropriate extracts of these, as well as the text of the *Regulae* can be found in *Oeuvres de Descartes,* eds. Charles Adam and Paul Tannery, vol. 10 (Paris: J. Vrin, 1966). (Hereafter abbreviated AT.) This version was unsurpassed until recently. In 1965, Giovanni Crapulli published an edition which uses all the available manuscript sources (AT uses the 1701 Latin edition and Leibniz's "Hanover" manuscript only): *Regulae ad directionem ingenii,* ed. Giovanni Crapulli (The Hague: Martinus Nijhoff, 1963). We will follow the English translation of Haldane and Ross (hereafter abbreviated HR), which is based on AT. *Rules for the Direction of the Mind,* in *Philosophical Works of Descartes,* trans. Elizabeth S. Haldane and G.R.T. Ross, V. I (Cambridge at the University Press, 1979), pp. 1–77. The textual challenge was formulated on the basis of AT, and the reply to this challenge made by Jean-Luc Marion, which we shall also consider, does not require Crapulli.

[2] "Mon dessein n'a point été d'enseigner toute ma Méthode dans le discours où je la propose, mais seulement d'en dire assez pour faire juger que les nouvelles opinions, que se verraient dans la Dioptrique, et dans les Météreos, n'etaient point conçues à la légère, et qu'elles valaient peut-être la peine d'être examinées," Au Vatier, 22 fév. 1638. AT 1:559 1. 13ff.

never explained in themselves or in their sequence. It is customary then to supplement the *Discours* with the *Regulae* which is a treatise that has method as its sole subject.[3] Even if the four rules of the *Discours* are the same in meaning as certain rules in the *Regulae,* as Gilson suggested, only the latter text has paragraphs and often pages which explain them and show their function. It alone connects method with the operations of the diverse faculties of knowledge, intellect, imagination, and sensation, and shows how their objects relate to the world. Of all the Cartesian writings, only the *Regulae* shows how method can found a science of the world. Accordingly, the *Regulae* has increasingly commanded attention in its own right as an autonomous source of Cartesian thought and not merely as auxiliary to later Cartesian texts. The weight we should assign to the *Regulae* is suggested by Heidegger: "Only one who has really thought through this relentlessly sober volume long enough, down to its remotest and coldest corner, fulfills the prerequisite for getting an inkling of what is going on in modern science."[4]

It is often thought that the primacy of metaphysics in the *Meditationes* supersedes the primacy of method in the *Regulae* and the *Discours.*[5] It is

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[3] Gilson notes that the *Regulae* and the *Discours* are in basic agreement: (". . . les deux ouvrages coïncident pour le fond"), but he maintains that the *Regulae* does not contain supplementary precepts, only more rules for the implementation of method. Gilson is among those who interpret teachings of the *Regulae* despite its textual problems and in the absence of a sufficient account of method in the work. *Discours de la méthode,* ed. with commentary by Etienne Gilson (Paris: J. Vrin, 1930), p. 196. Most consider it to be subordinate to the account in the *Discours.* Exceptions to this are Norman Kemp Smith, *Studies in the Cartesian Philosophy* (New York: Russell and Russell, 1962) and L. J. Beck, *The Method of Descartes* (Oxford at the Clarendon Press, 1952). See Beck, p. 6 for a brief account of this controversy. Since Beck's study, J. L. Marion has also argued that the *Regulae* is an important Cartesian source on method. See *L'ontologie grise de Descartes* (Paris: J. Vrin, 1975). Lüder Gäbe, *Descartes Selbstkritik* (Hamburg: Felix Meiner, 1972) also finds the details of method in the *Regulae* but argues that Descartes rejects the teaching of the *Regulae* after reading Francis Bacon. Jean-Louis Allard claims that method is a generalization of the method of universal mathematics found in the *Regulae,* and that the entire Cartesian system is ordered accordingly. But Allard does not substantiate his position. See *La mathématicisme de Descartes* (Ottawa: Éditions de l'université d'Ottawa, 1963). Some scholars maintain that method cannot be understood apart from concrete applications. This view follows Descartes's remarks to Mersenne: ". . . car je ne mets pas *Traité de la Méthode,* mais *Discourse de la Méthode,* ce que est le même que *Préface ou Advis touchant la Méthode,* pour montrer que je n'ai pas dessein de l'enseigner, mais seulement d'en parler. Car comme on peut voir de ce que j'en dis, elle consiste plus en Pratique qu'en Théorie . . ." À Mersenne, mars, 1637. AT 1:349, 1. 16–28. See for example, C. Serrus, *La méthode de Descartes* (Paris: Alcan, 1933), pp. 2–3; L. J. Beck, *The Method,* pp. 7–8. Beck turns to the *Regulae* but maintains that the account of method is essentially the same in both, pp. 150–151.

[4] Martin Hediegger, *What is a Thing?,* trans. W. B. Barton, Jr. and Vera Deutsch (Chicago: Henry Regnery Company, 1967), p. 101.

[5] The debate about the relationship of method and metaphysics has been going on for some time. Charles Serrus's *La méthode de Descartes* (Paris, 1933) argued that the method of which was valid in mathematics and physics, was not the method used in the *Meditations.* Fernand Alquié some time later maintained that Descartes turned from the method of the

more useful to speak of a fundamental plane on which there is a continuity of problems between these texts. This premise allows us to appreciate fully those doctrines presented in the *Meditationes* which were originally and often more amply developed in writings on the methodology of philosophy. This tactic has *prima facie* cogency: Descartes's "Dedicatory Epistle" presents the *Meditationes* as an employment of method, one which, we learn at the outset of Meditation I, supplies the foundation for the edifice of all the sciences.[6] For example, it is clear in Meditation VI that the celebrated ontological dualism must meet the demands of scientific cognition. The *res cogitans* must be not only an independent substance, but an intellect which functions both independently of and in conjunction with imagination and sensation in knowing the world. But these requirements are first explored in the universal method of the *Regulae,* in formulations which are often merely echoed in condensed form in the *Meditationes.*

Descartes makes his decisive, methodological turn away from traditional modes of philosophizing in Rule IV of the *Regulae.* Only through a universal method—"certain and simple rules"—can we "arrive at the true knowledge of all things." Ironically, this very rule obstructs a clear view of universal method. In what seems to be a separate but similar discussion, Rule IV abandons universal method about mid-way, and takes up an altogether new theme, universal mathematics (*mathesis universalis*).[7] Taking this cue, Jean-Paul Weber challenged the literary integrity of Rule IV and of the entire *Regulae.*[8] In response, recent scholarship has centered on Rule IV, specifically on the

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Regulae, a non-metaphysical method, to a metaphysics, as a result of a "metaphysical discovery of man." See *La découverte métaphysique de l'homme chez Descartes* (Paris: Presses universitaires de France, 1950). Leslie Beck's studies, *The Method of Descartes* (Oxford at the Clarendon Press, 1952) and *The Metaphysics of Descartes* (Oxford at the Clarendon Press, 1965) challenge these interpretations, arguing that the same method of the *Regulae* and the *Discours* is at work in the *Meditations.* Margaret Wilson's new volume, *Descartes* (London, Henley and Boston: Routledge and Kegan Paul, 1978), attempts to place the arguments of the *Meditations* within the twofold intention of that work—to provide foundations for the sciences and proofs for the existence of God and distinction of soul and body. She interprets the procedure of methodic doubt in this light, and does not study the relationship of the *Meditations* to the earlier treatises; however, she does maintain that the *Meditations* supersedes method. See pp. 222–223.

[6] HR, pp. 134–135, 144; AT 7:3, 1. 22ff.; p. 17.

[7] Harold Joachim noticed the discrepancy between the two parts of the rule, and concluded that Descartes was "confused": "Owing to the origin of Descartes' conception of method he tends to confuse it with science and is led to speak of his new science of order and measure." Harold H. Joachim, *Descartes' Rules for the Direction of the Mind,* Reconstructed from notes taken by his pupils, ed. Errol E. Harris (London: George Allen & Unwin, Lt., 1957), p. 62.

[8] Jean-Paul Weber, *La constitution du texte des Regulae* (Paris: Société de édition enseignement supérieur, 1964). We may disagree with specific theses of Weber, but the practice of recent scholars to utilize the *Regulae* while ignoring its textual problems is highly questionable. See, for example, Bernard Williams, *Descartes: The Project of Pure Enquiry* (New Jersey: Humanities Press, 1978), p. 28.

relationship between universal method and universal mathematics. Since the result of these studies has been to conflate the two—to anticipate our conclusion—the interpretation of that Rule is of primary importance.

In his *La constitution du texte des Regulae* (1964) Weber argued that the *Regulae* is a patchwork of Cartesian passages, all genuine but written at different times in Descartes's development. Weber concluded that the *Regulae* is a collection of fragments which must reflect the intellectual history of the young Descartes. It is Rule IV, he maintained, that provides the strongest evidence for his thesis. Following the clue provided by the Hanover manuscript, Weber held that Rule IV, as it stands in the Adam-Tannery edition, is actually composed of two heterogeneous sections. In the first section Descartes argues the indispensability of a single, universal method, while the second, which begins with the autobiographical phrases, "When first I applied my mind to mathematics . . ." (Haldane-Ross, I, p. 11), is devoted exclusively to "universal mathematics"—*mathesis universalis*. Weber designates these two sections IV–A and IV–B respectively.[9] (We shall follow this designation in our discussion.)

The significance of Weber's results was recognized in Jean-Luc Marion's study, *L'ontologie grise de Descartes*.[10] Marion reads the *Regulae* against the background of the Aristotelian corpus, and regards Descartes's teaching as a reinterpretation of the Aristotelian notion of being. He acknowledges the seriousness of Weber's evidence about the heterogeneity of IV–A and IV–B, but interprets their relationship in a way which permits him to support the continuity of the two parts, and hence the integrity of Rule IV. Marion agrees with Weber that Rule IV is composed in two sections with parallel structures, but contends that the parallelism is deliberate. IV–B, which presents the science of *mathesis universalis*, shows that the certainty of this science must be extended in scope and grounded in order to become a standard for all science whatsoever. In brief, by a meta-mathematical reflection, *mathesis universalis* in IV–B is transformed into a universal method, in IV–A.[11] Clearly the argument between Marion and Weber, and the solution to the textual problem of Rule IV, turns upon the philosophical relationship between *mathesis universalis* and method.

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[9] IV–A: AT:371 l. 1–374 l. 15; HR pp. 9–11; IV–B: AT:374 l. 16–379 l. 13; HR pp. 11–14.

[10] Marion, *L'ontologie;* Marion is the first response to Crapulli's edition. Although Gäbe proposes an interpretation of method in the *Regulae*, he does not attend to the *Regulae* as a whole, nor does he spend any time on Rule IV. Marion's analysis of Rule IV is found on pp. 55–69.

[11] "En recherchant la spécificité des mathématiques commes telles, Descartes tente une régression en decà de l'abstraction de la 'matière' (définissant les mathématiques selon Aristote), jusqu' à une abstraction plus radicale et donc universelle. Dégageant la mathématicité des mathématiques, loin de prétendre 'mathématiser' tout le savoir, Descartes entreprend de mettre au jour le secret commun de la certitude et de l'organisation des sciences—secret que, parce qu'antérieur aux mathématiques, peut s'étendre au-delà de leur region," p. 61.

Prior to the studies of Weber and Marion, the most significant treatment of universal method and *mathesis universalis* in the *Regulae* had been that of Jacob Klein. Klein's invaluable study, *Greek Mathematical Thought and the Origin of Algebra,*[12] is devoted to the opposition between ancient and modern understandings of mathematics, especially regarding "number." According to Klein, universal method is derivative from *mathesis universalis.*[13] He assumes, although without explicit discussion, that Rule IV can be read as a single, continuous text. Thus, prior to the emergence of the textual problem brought into prominence by Weber, Klein appears to anticipate Marion's resoltion of the problem. However, for Klein the *mathesis universalis* is not defective, e.g., as regards certitude, in Descartes's eyes, and hence not in need of a meta-mathematical transformation. *Mathesis universalis* stands as the authoritative science, and even furnishes the rules for the universal method. This way of reading the *Regulae* is jeopardized by the heterogeneity thesis of Weber.[14]

Weber's study is not merely a cogent challenge to the textual integrity of the *Regulae.* His thesis about Rule IV nullifies the only thematic discussion of the necessity of method and universal mathematics in the Cartesian corpus. Since method governs the teachings of the *Regulae,* the relationship between

[12] Jacob Klein, *Greek Mathematical Thought and the Origin of Algebra,* trans. Eva Brann (Cambridge, Mass. and London: M.I.T. Press, 1972).

[13] *Ibid.* See pp. 197ff.

[14] John A. Schuster, in his recently published article, "Descartes' *Mathesis Universalis:* 1619–28" (in *Descartes: Philosophy, Mathematics and Physics,* ed. Stephen Gaukroger, New York, Barnes and Noble, 1980, pp. 41–97), argues that the *Regulae* belongs to two different stages of composition. Between his first conception of a unified mathematical discipline, *mathesis universalis* (not later than Nov., 1619), and the full attempt at its justification (1628), Descartes was misled by a "delusive myth"—that by rules or method he could describe the cognitive source of the true judgments and that he could set forth heuristic aids to inquiry. To this transitory stage belong Rules I—VII, and perhaps part of Rule VIII and Rules IX and XI, according to Schuster. But this excessively narrow interpretation of method cannot be supported by the text of Rules I–VII. Schuster ignores not only the stated goals of the *Regulae* but the complexity of method. The teaching of simple natures in Rule VI and the procedure of enumeration outlined in VII, for example, show that Rules V–VII are not mere heuristic rules, but are the core of a new order of demonstration, one which, it must be added, is not "hard" deductivism, as Schuster claims.

For Schuster, only Rules XII and following belong to the later stage when Descartes attempted justifying *mathesis universalis,* by which the object of mathematics is identified with the substance of the world. Schuster follows Klein this far, but, unlike Klein, Schuster claims that *mathesis universalis* is legitimated by a "nexus" of optics, psychology and physiology (the "o-p-p nexus") found in Rule XII and developed in Rule XIV. According to this author, Cartesian optics is the paradigm for such an account. Schuster fails to comprehend that the geometrical mechanism of Rule XII, according to which all sensible differences can be represented by different geometric figures, cannot be accomplished by optics alone. Even if optics is a paradigm for the teachings of Rule XII, it presupposes the new mode of conceptuality which Klein names "symbol-generating abstraction," a conceptuality produced not by science but by method. Schuster is at once too lax and too thorough. He oversimplifies method, the most conspicuously prevalent subject of the *Rules,* in order to legitimate universal mathematics, a science mentioned once only, in the early fragment, IV–B.

method and *mathesis universalis* is crucial, as both Marion and Klein agree. But Weber's thesis makes it impossible to investigate the relation between the two. We can escape this impasse, however, by examining and limiting Weber's hererogeneity thesis. Then we shall be in position to evaluate decisively both Marion and Klein and to relate *mathesis universalis* and universal method so that the textual and philosophical difficulties of Rule IV are solved. The turn to universal method in Rule IV is nothing less than Descartes's philosophical turn. A crucial result of this turn was an account of scientific cognition, of mind and its functions, which Descartes modified but never abandoned. The solution to the problem of Rule IV provides the key to reading the *Regulae* as a whole, by exposing the true beginning and general structure of Cartesian method. Thus, it clears the way for a definitive interpretation of the *Regulae,* and, ultimately, for a richer understanding of the *Meditationes.*

II. WEBER'S HETEROGENEITY THESIS

Weber's general thesis about Rule IV must be divided into two distinct conclusions: (a) the textual heterogeneity of the two parts of IV; and (b) the impossibility of establishing a relationship between them. The first conclusion is persuasive and can be strengthened; the second, we hold, must be rejected.

Initially Weber observed that there is a marked shift in the subject matter of IV from the opening theme of universal method, which accords with the enunciation of IV ("There is need of a method for finding out the truth"), to the theme of *mathesis universalis.* Once the autobiographical account begins, method is no longer mentioned; from that point forward, *mathesis universalis,* hitherto not mentioned, becomes the theme. No statement relates them. This is the first of four indications of the heterogeneity of IV–A and IV–B. Secondly, each section can be read and comprehended as a whole independently of the other. Neither account requires or is aided by the other. Thirdly, within a striking parallelism of structure in the two sections there is a repetition of detail. Themes in the exposition of method are repeated point by point in the exposition of *mathesis universalis.*[15] Thus, the beginning

[15] Weber finds these points of parallel in IV:

IV–A	IV–B
1. 371 1.14–25: Inconvenience resulting from role accorded to chance in scientific discovery.	1. 374 1.16—375 1.22: Inconvenience resulting from ordinary way of studying, with too much reliance on chance.
2. 371 1.25—373 1.2: Idea of Universal Method.	2. 377 1.9—378 1.11: Idea of a Universal Mathematics different from classical mathematics.
3. 373 1.25—374 1.15: Method	3. 375 1.22—376 1.20: Analogous

of each section warns against reliance on luck and chance in scientific procedure. Each then discusses its main topic, method in IV–A, *mathesis* in IV–B, but making the same point—that the ancients had an incipient knowledge of this subject, and that the analysis of the ancients and modern algebra are the fruits of this knowledge. Each section then concludes with remarks on the excellence of the more comprehensive knowledge: method is called the source of all instruments of knowledge in IV–A, and in IV–B *mathesis universalis* is "more excellent" than all the sciences subordinate to it. The only difference in structure that Weber finds is Descartes's assertion in IV–B that he will go on to "more elevated" sciences. Fourth, the argument for universal method in IV–A relies on the chain of argument of Rules I–III, and is consistent with the subsequent rules; whereas neither the term "*mathesis universalis*" nor the arguments of IV–B are mentioned or used in any other part of the *Regulae*.

Weber ignores one very marked discrepancy between the two parts which strengthens this heterogeneity. In both Descartes refers to earlier mathematicians and relates their knowledge to "seeds" in the human mind (*ingenium*),[16] but in IV–B algebra is complicated and confused, whereas in IV–A it is "flourishing." In IV–B "men of talent" are trying to revive the ancient "traces of true Mathematics," found in Pappus and Diophantus, in a science of algebra, but Descartes tells us that this task is by no means completed: ". . . if only we could extricate it from that vast array of numbers and inexplicable figures by which it is overwhelmed, so that it might display the clearness and simplicity which . . . ought to exist in a genuine mathematics." But in the preceding discussion of IV–A, algebra, so far from being afflicted with such difficulties, is "flourishing" and is coupled with "analysis" as "spontaneous fruit sprung from the inborn principles of method." Analysis and

anticipated by seeds of truth in human spirit.	affirmations about *Mathesis Universalis*.
4. 373 1.11–24: Analysis of ancients and algebra are spontaneous fruits of method	4. 373 1.21—377 1.9: Analysis and algebra are fruits of *Mathesis Universalis*.
5. 373 1.25—374 1.15: Excellence of method over all other human knowledge.	5. 378 1.11–25: *Mathesis Universalis* surpasses the subordinate sciences in utility and ease.

[16] The term "ingenium" is ordinarily translated by "mind" in English: however, this does not capture the inborn or inchoate sense that the text conveys. Norman Kemp Smith chooses "native power" for his translation (*Philosophical Writings*, N.Y.: Modern Library, 1958), but this neglects the fact that it is a knowing power. The English "intelligence" is closer. It stresses the intellectual aspect and does not rule out the sense of a natural ability. Marion's annotated translation of the *Regulae* neglects comment on "ingenium." See *Règles utiles et claires pour la direction de l'espirit en la recherche de la verité*. Translated by J. L. Marion (The Hague: Martinus Nijhoff, 1977).

algebra together have "yielded results so much more satisfactory than others in which greater obstructions choke all growth." We conclude that Descartes's estimate of algebra was enhanced either by growing familiarity with the science, or in virtue of his own contributions to the science, a conclusion supported by *Discours* II.[17] Weber's heterogeneity thesis about IV–A and IV–B is thereby strengthened, but, as has been generally overlooked, we are able to infer that the *mathesis universalis* of IV–B belongs to an earlier phase of Descartes's thought than the method of IV–A, and the entire *Regulae*.

Weber suggests three possible relationships between universal method and *mathesis universalis* but denies that any of the three can be defended. First, the two cannot be synonymous, since method is universally applicable to all subject matter and is the source of all human knowledge, whereas *mathesis universalis* is only a science of "*ordo et mensura*" and hence superior only to particular mathematical sciences. Secondly, *mathesis universalis* is not acquired as a result of reflection on method, but by reflection on mathematics in general, as Descartes attests.[18] In IV–A Descartes does not imply that algebra and geometry are acquired through method, but does say that they are spontaneous fruites born from the innate principles of method. Thirdly, *mathesis universalis* is not propaedeutic to method, since in IV–B Descartes explicitly states that he will turn away from this science in order to go on to loftier sciences. Weber interprets this statement to mean that he must turn away from mathematics in order to turn to philosophy: mathematics must be "put in parenthesis."[19]

But Weber too quickly eliminates this third possibility. Descartes does indicate that he will think about loftier sciences. ". . . up to the present time to the best of my ability, I have made a study of this *mathesis universalis;* consequently, when I go on to deal in their turn with more profound sciences, as I hope to do soon, my efforts will not be premature." Even if "more profound sciences" should refer to philosophy, the statement does not imply that Descartes would leave mathematics behind in turning to philosophy, as Weber holds. The possible ways of establishing a relationship between *mathesis universalis*, which is evidently earlier in conception, as we shall argue more fully, and universal method, have not been fully explored by Weber. Instead of divorcing the *mathesis universalis* of IV–B from all serious connection with the body of the *Regulae* as we have it, we should attempt to establish the connection suggested by the presence of IV–B in all the extant manuscripts. Some of these considerations help to explain the novel strategy attempted by Marion.

[17] AT 7:11ff.; HR pp. 87ff.
[18] AT 10:377 l. 9–16.
[19] Weber, *La Constitution*, p. 10.

III. MARION'S "RECONSTITUTION" OF RULE IV

Marion intends to offer us a "sketch of the reconstitution" of Rule IV. He acknowledges that the division of the text into two sections has been "often remarked," yet he mentions only Weber's division. Weber's heterogeneity thesis is Marion's target and his example. Because of the repetitions within parallel structures, Weber concluded that the two sections must be altogether different. Marion, however, radicalizes their similarity—he finds the two isomorphic—but then turns this against Weber's thesis: to Marion Rule IV is a single continuous argument which requires that themes be repeated in a structurally identical sequence.[20] Thus the shift from method to universal mathematics implies a contradiction only in the mind of Weber, not in that of "the thinker, Descartes." If there are discrepancies in the respective accounts, they must serve the unifying intention of the author.[21]

Marion's thesis stands or falls on its ability to overcome factual discrepancies, since on his view IV–A and IV–B cannot belong to different stages of Descartes's intellectual development. The theme of certainty links the two sections according to Marion.[22] Method overcomes the insufficient certitude of mathematics, which cannot account for its own certitude, by means of a "radical abstraction"[23] which simultaneously transforms mathematics into *mathesis universalis*. Thus there are two solutions to the problem of certainty: according to Marion, Descartes presents method before showing that there is a problem within mathematics, and then shows that mathematical insuffi-

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[20] Marion's division of Rule IV:

IV–A	IV–B
1 371 1.4–25: Lack of certitude leads to method.	1 374 1.16—375 1.22: in mathematics "certain" experience lacks art.
2 371 1.25—373 1.2: Formal definition of method as producer of certitude.	2 375 1.22—376 1.8: Vague presentiment of a prior mathematics.
3 373 1.2–24: Two privileged mathematical sciences refer to method.	3 376 1.8—377 1.9: Two prior mathematical sciences refer to *Mathesis*.
373 1.8–9: First seeds of reflection.	376 1.12–13: Seeds of truth.
4 373 1.25—374 1.9: Knowledge of any subject, universal knowledge.	4 377 1.9—378 1.11: *Mathesis Universalis* knows order and measure regardless of the subject.
5 374 1.9–15: Method is prior to other sciences.	5 378 1.11—379 1.13: *Mathesis* has propaedeutic value to reach other sciences.

[21] Marion seems to have been inspired by Heidegger both for his specific interpretation of the *mathesis universalis*-method relationship, and for the guiding theme of his study of the *Regulae*—that Descartes reinterprets "Being." See M. Heidegger, *What is a Thing?*, pp. 98–106.

[22] Marion, *L'ontologie*, p. 56ff.

[23] *Ibid.*, p. 62.

ciency is surmounted by *mathesis universalis*. What unity of thought does Marion ascribe to Descartes?—that Descartes acquires a method with "meta-mathematical traits" but universal scope.[24]

We begin with one observation which by itself suffices to shake Marion's thesis. In IV–B Descartes does not mention any insufficiency in mathematical certitude. Whereas "certain" or some cognate word occurs four times in IV–A,[25] it or its cognates are entirely absent from IV–B. The rules of method are designated as "certain," but neither universal mathematics nor any science subordinate to it is said to be certain—or uncertain. Descartes does indicate that mathematics is in need of simplification and clarification of its objects and procedures, but he is wholly silent about its certitude. Why should Marion impose insufficient certitude on mathematics when Descartes does not? Because Marion imposes this theme on IV–B, his list of parallels between the two sections is defective. Marion's very first point is a comparison between the lack of certitude requiring method in IV–A and the need in IV–B for an art to supplement the "certain experience" of mathematics.

Other glaring discrepancies occur in Marion's account. He is either unaware of or ignores the different status of the same science, algebra, in the two sections—"flourishing"in IV–A and "overwhelmed" with "inexplicable figures" in IV–B. Could Descartes have combined in a continuous account such incompatible descriptions? Furthermore, Marion is undisturbed by the fact that whereas in IV–A we are told that by method we can arrive at the "knowledge of all things," in IV–B *mathesis universalis* holds sway over a mathematical domain only, the domain of "*ordo et mensura.*"[26]

Marion's attempted "reconstitution" fails to explain how the two sections of Rule IV can be read as a single exposition. Why would Descartes present an entire discussion of method prior to the problem it is supposed to solve? And, having done so, why would he solve the problems of mathematics through *mathesis universalis* without even so much as a sentence or phrase

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[24] *Ibid.*, p. 64, where Marion calls it, "A non-mathematical meta-mathematics."

[25] AT 10:370 l. 5; 371 l. 16 and l. 26; 374 l. 2.

[26] In his study ("Descartes' *Mathesis Universalis*," *Archiv für Geschichte der Philosophie*, v. 62 [1980], pp. 154–174), Frederic Van de Pitte is in agreement with Marion that *mathesis universalis* is more fundamental than a mathematical science of quantity, and that it is identical with universal method. Relying on a terminological revision of a single passage from IV–B (AT 10:377 l. 12—378 l. 11), Van de Pitte equates *mathesis universalis*, a science of order and measure simply, with a superior science which provides the fundamental principles of all knowledge and inference. We need not dwell on the most obvious deficiency of this interpretation—that it does not explain the repetition of themes with their variations within Rule IV. Completely absent from Van de Pitte's analysis is any account, much less any textual justification, for identifying a science of order and measure with a universal method of scientific reasoning.

linking it with method? In the final paragraph of IV–B we learn that Descartes may go on from universal mathematics to "higher sciences." There is no word about method—or philosophy, for that matter. Moreover, we are told in IV–B that Descartes writes the previous exposition into "this little book" as a memo to himself. Marion does not show how to reconcile this with the concluding part of IV–A, where the writing is described as a "Treatise."[27] Not only are these discrepancies unresolved, but Marion does not explain the repetition of facts and formulations within the two sections, for example, the mention of algebra and the phrase "first seeds" which occur in both.

Marion's thesis, if taken seriously, accomplishes the precise opposite of its intention. Because it demands unreasonable tolerance for the repetitions, discrepancies and contradictions in the two sections, it compels us to deplore the incompetent writing of a novice.

IV. KLEIN'S IDENTIFICATION OF *MATHESIS* AND METHOD

According to Jacob Klein, within the *Regulae* Descartes discloses the assumptions of the concept of number which lie at the basis of algebra. Because Klein's aim is to elucidate this, a new mode of conceiving number, and not to interpret Rule IV, he focuses his analysis almost exclusively on Rule XIV, yet his exposition is guided by his understanding of *mathesis universalis* and its relation to method. He maintains that *mathesis universalis* is algebra and that method rises out of Descartes's desire and need to justify his own identification of the object of algebra with "the 'substance' of the world, with corporeality as 'extensio'."[28] Thus, in a brief passage, Klein offers us no less than a possible interpretation of Rule IV:

> In general Descartes' "method" grows out of a desire to justify the *place* which he assigns to algebra. The point of view of "methodical" cognition is therefore secondary for the *original* identification of the "general" mathematical object with extension having figure. But since everything depends on the *justification* of this identification, the "method" gradually gains a more and more central significance, *while its rules* are borrowed from the "*mathesis universalis*" itself; thus, the road of "inventio," which the "mathesis universalis" understood as "general algebra" follows, is discovered to be the way of cognition generally most appropriate to the human understanding. In this sense the "Regulae ad directionem ingenii" ("Rules for the direction of the mind") are indeed identical both with the "rules" of the "*mathesis universalis*" and with those of the "method" as such.[29]

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[27] The *Regulae* is called a "Treatise" in five other places: AT 10:381 l.9; 392 l. 6; 399 l.22; 432 l. 13; 459 l. 2.

[28] Klein, *Greek Mathematical Thought*, p. 197.

[29] *Ibid.*, p. 294, n. 310.

On Klein's account, method is an extension of *mathesis*, since *mathesis* gives rules to method; but *mathesis* is justified by method, since the methodical account of cognition explains the possibility of *mathesis*. But this makes Descartes's method crudely circular.

Klein's uncritical acceptance of the text of Rule IV undermines his thesis. He summarily identifies algebra with *mathesis universalis*, but this is unwarranted. Where the two are mentioned together, in the same paragraph in IV–B, they cannot be assimilated to one another. In an attempt to renew a specific art—the work of Pappus and Diophantus is not distinguised by Descartes[30]—talented men are working at algebra, but it is riddled with problems. *Mathesis universalis*, because it is a science of order and measure, could, indeed, be algebra, once algebra has been rectified, but in IV–B algebra is, at best, only implicitly *mathesis universalis*. Consequently, Klein's identification of the two is plausible only at the time of IV–A, when *mathesis universalis* drops out of sight.

Klein ascribes rules to *mathesis universalis*, but, in fact, there is not a trace of the word "rule" in the whole of IV–B. No techniques or procedures are described for it. Consequently rules of method cannot have come from rules of *mathesis universalis*. But neither can rules of algebra be rules of method. No doubt the "flourishing" algebra of IV–A has clear procedures, but even when we equate them with the procedures of a science of order and measure, such as is described in Rule XIV, the rules of algebra are narrower than those of method. Klein himself describes algebra, a mathematics which has at its basis the order of numbers.[31] Rules of method, the methodology described in Rules V–VII, govern logical sequence, the order of things

[30] Klein tells us that the books of Diophantus's *Arithmetica* which have come down to us ". . . essentially teach the solution of those computational problems which are known today as determinate and indeterminate equations of the first and second degree." Klein continues, "In the course of his presentation Diophantus uses, besides various other signs, a series of abbreviations for unknowns and their powers which enter into the calculation itself, thus lending it an 'algebraic' character. This is why Diophantus could come to be called—always with certain reservations—the 'inventor' or 'father' of our present-day algebra." p. 126. In Pappus's *Collectio Mathematica*, ed. F. Hulsch (Berlin, 1876–78) there is a definition of "analysis" and "synthesis." (See Klein, p. 260, n. 218. See also *Greek Mathematical Works* ed. Ivor Thomas [Cambridge: Harvard University Press, 1941] II, pp. 597–601.) Jaakko Hintikka and Unto Remes have studied Pappus's geometrical analysis, and have translated it into the language of contemporary logic. They consult Klein, but do not take a stand on two points fundamental and persuasive in Klein's study. The first of these is the difference between analysis in mathematics and in philosophy. The second is the transformation of the concept of number, which, Klein argues, is the watershed dividing ancient mathematics from modern.

[31] ". . . 'multitude' here means one of those numbers with which 'algebra' deals in setting up proportions among 'A,' 'B,' and 'C'; these need no longer be referred to the 'common measure' because measuring (*mensura*) is no longer our concern, but only 'arrangement' (*ordo*)," Klein, *Greek Mathematical Thought*, p. 204.

known as they are known from one another. The order of numbers is but one of the ways in which things may be known from one another. Thus it is entirely possible that method could justify the "place" which Descartes gives to algebra, as Klein maintains, but if it does so, it is not by using the very methodology it intends to justify.

The central difficulty of Klein's approach is apparent at the outset of the paragraph quoted above. Klein assumes that an "original identification" of the " 'general' mathematical object with extension having figure" precedes its justification by method. The identification, on Klein's reading, would necessarily be made within *mathesis universalis.* But this is quite obviously impossible. Universal mathematics is a purely mathematical science, a science of "*ordo et mensura.*" The identification of mathematical objects with the substance of the world, with "extension having figure," demands attention to many extra-mathematical considerations. It especially requires an account of the cognitive faculties and how they are related to the world: the constitution of mind must be such that it can and needs to make this identification. The doctrine of scientific cognition, however, is an integral part of the *Regulae* as a whole to which IV–B does not belong. The "identification" stressed by Klein is not prior to method, but is the very burden of the *Regulae.* It is, then, not merely the identification of the mathematical object with the substance of the world that is at issue, but the capacity of a single, universal method to grasp its subject matter in the "sciences taken all together," the "human wisdom" referred to in Rule I.

V. FROM UNIVERSAL MATHEMATICS TO UNIVERSAL METHOD IN THE *REGULAE*

It is now clear that the two sections of Rule IV, IV–A and IV–B, are heterogeneous in both intention and theme. IV–B is an earlier writing, a memo in which Descartes describes universal mathematics.[32] IV–A, on the other hand, is part of the *Regulae ad directionem ingenii,* a treatise on the universal method for arriving at human wisdom. Admittedly the two sections have stylistic and thematic parallels: the first section of each points out a condition that needs clarification; each uses the term "first seeds" and mentions algebra; each has a statement of purpose; each proposes a universal science; moreover, the two are found together in two manuscript sources. Evidently Descartes thought it useful to keep IV–B at hand as a model, making alterations as he went along, while composing IV–A.

Yet we should not allow these similarities to blur our view of their

[32] See other expressions of this interest: Beeckman's *Journal* entry, AT 10:63–65; Descartes' letter to Beeckman, *Ibid.,* p. 165 (29 avril, 1619); and *Cogitationes privatae, ibid.,* p. 218 l. 21—219 l. 2.

marked difference. Only when we see that the universal method of IV–A is not confined to the restricted scope of a science of "*ordo et mensura*," as universal mathematics in IV–B is, can we appreciate that IV–A alone belongs to Rule IV, and that the *Regulae* is a philosophical treatise. The method it espouses is a philosophic method, capable of a comprehensiveness not possible within universal mathematics. Method is a single procedure for reasoning altogether, the order of things as they are known from one another. It cannot be restricted to the order of numbers, to a mathematical order. In IV–A alone order extends over the domain of all knowing.

Universal method is grounded in a standard of certainty, the presence of indubitable evidence to mind. While mathematical science may meet this standard, and even be the outstanding example of it, *mathesis universalis* does not require an account of the possibility of such evidence. Only the universal method of the *Regulae* requires that the truthful cognitive operations by which this evidence is available, intuition and deduction, be described. Moreover, because a single scientific method is appropriate to all science, it provides knowledge of the world. The *Regulae* explains how intellect knowing with certainty works with the cognitive powers which relate knowing to the world, i.e., imagination, memory, and sense. In short, only because universal method is philosophical does it require a methodology of rules or procedures ordered to the goal of human wisdom.

When we see that in Rule IV and, consequently, in the *Regulae* Descartes makes a decisive philosophical turn, the relevance of the *Regulae* for the *Meditationes* can be appreciated. With this turn, Descartes assumes the task of showing that mind, which is capable of indubitable knowledge merely by attending to what is psychologically present to it, is also capable of scientific knowledge of the world. Thus the *Regulae* articulates the cognitive presuppositions of universal method, presuppositions which impose dualism upon Cartesian thought, even before the ontological commitment to the two substance doctrine of the later *Meditationes*. In Rule XII[33] Descartes departs from the traditional account of perception, according to which each of the senses has a "proper object," a sensible quality which it alone can perceive. Instead, he gives a fully mechanical explanation which effectively eliminates the differences between the several senses as well as the sensible qualities to which they are directed. All sensation is the reception of figure upon the body "just in the way that wax receives an impression from a seal." This figure is transmitted through corporeal organs—through common sense to imagination, which is located in the brain.

[33] The account of scientific cognition is found in Rule XII, HR, pp. 36–40; AT10:412 l. 14—417 l. 14; Rule XIV contains a description of knowing in the specific context of acquiring "general magnitudes." Klein mistakenly took this passage as the locus of the whole problem of cognition in Descartes. HR, p. 59–60; AT:445—447.

Descartes describes the cognitive power (*vis cognoscens*) as a "single agency," one which is "purely spiritual," yet this cognitive power both acts upon and receives "impressions" from corporeal organs: "It is one and the same agency which, when applying itself along with the imagination to the common sense, is said to see, touch, etc.; if applying itself to the imagination alone in so far as that is endowed with diverse impressions, it is said to remember; if it turn to the imagination in order to create fresh impressions, it is said to imagine or conceive." The cognitive power "understands" when it "acts alone," but even in this function it can and often must interact with a corporeal organ if it is to know the world: ". . . if the understanding (*intellectus*) deal with matters in which there is nothing corporeal or similar to the corporeal, it cannot be helped by those faculties, [imagination, sense, memory] but that, on the contrary, to prevent their hampering it, the senses must be banished and the imagination as far as possible divested of every distinct impression. But if the understanding proposes to examine something that can be referred to the body, we must form the idea of that thing as distinctly as possible in the imagination."

The terms of this dualism are repeated in the cognitive requirements of Meditation VI, in abbreviated fashion.[34] The *res cogitans* cannot be understood as bodily, and it can know truths "alone," i.e., "without the help of imagination," but it can also imagine, and when doing so, must interact with body: ". . . when I attentively consider what imagination is, I find that it is nothing but a certain application of the faculty of knowledge to the body which is immediately present to it . . ." The thinking thing can both turn "to itself" or turn to body: "And I easily conceive that if some body exists with which my mind is conjoined and united in such a way that it can apply itself to consider it when it pleases, it may be that by this means it can imagine corporeal objects; so that this mode of thinking differs from pure intellection only inasmuch as mind in its intellectual activity in some manner turns on itself, and considers some of the ideas which it possesses in itself; while in imagining it turns towards the body, and there beholds in it something conformable to the idea which it has either conceived of itself or perceived by the senses."

The differences between the accounts in the *Regulae* and in the *Meditationes* are equally striking. For example, in *Meditationes* the thinking thing is a spiritual substance, known as such by mind alone. It, like corporeal substance, cannot be known through sensation or imagination: ". . . since it is now manifest to me that even bodies are not properly speaking known by the senses or by the faculty of imagination, but by the understanding only, and since they are not known from the fact that they are seen or touched,

[34] HR, p. 185ff.; AT 7:71ff.

but only because they are understood, I see clearly that there is nothing which is easier to me to know than my mind."[35] The *Regulae* not only does not give the "spiritual" *vis cognoscens* an ontological description, it specifically warns us about the mind acting alone: ". . . we make it a rule not to recognize those metaphysical (*philosophica*) entities which really cannot be presented to the imagination. For even though someone could persuade himself, for example, that supposing every extended object in the universe were annihilated, that would not prevent extension in itself alone existing, this conception of his would not involve the use of any corporeal image (*idea*), but would be based on a false judgment of the intellect working by itself."[36] Knowing, as well as doubting and willing, are singled out as "purely intellectual" natures in Rule XII, and of these natures it is "impossible to construct any corporeal idea" to represent them to us. The ontological implications of scientific cognition in the *Regulae* are in direct opposition with the metaphysical claims based upon scientific cognition in the *Meditationes.*

That the two writings can agree about the requirements of scientific cognition, while reaching antithetical conclusions with regard to the metaphysical commitments these requirements imply, is further substantiation that the *Regulae* is indispensable for the *Meditationes.* In a forthcoming study, we shall show that the teachings of the *Regulae,* here only adumbrated, can guide us to a more accurate and profound reading of dualism in the *Meditationes.*

Catholic University of America

[35] HR, p. 157; AT:34 l. 1–6.
[36] HR, p. 57; AT:442 l. 25—443 l. 3.