

## VIII

## CONCLUSION: THE PROBLEMS OF THE METHOD

## § 1

WE have followed out historically the weakness of a classical attempt to employ the mathematical method. We may now observe that that weakness is due to the limitations of the mathematical mind. On this point we can do no better than consult Pascal.

Pascal's general criticism of Descartes is epitomized in the four paragraphs of the *Pensées*<sup>1</sup> specifically directed against him. The first is a note to write against those who 'probe the sciences'; the second, the famous 'I cannot pardon Descartes'; the third, the condemnation of Descartes as 'useless and uncertain'; the fourth, the protest against Descartes' attempt to explain the detail of the cosmic machine. They form a protest against Descartes' physics, but they are more than that. They are a protest against Descartes' whole outlook, not only his physics but also his aims: 'even if it were true, the whole philosophy [i.e. physics] would not be worth spending an hour upon'.

The significance of these remarks is only to be understood in the light of Pascal's own 'discourse on Method'.<sup>2</sup> This sets out from the contradiction of the Cartesian conception of the mathematical key

<sup>1</sup> §§ 76-9 (ed. Brunschvicg). <sup>2</sup> Brunschvicg, *Pensées*, section 1.

opening the door of nature for all men alike. Men differ in type of mind: each type has its own method and each method its own deficiencies. Far from the supreme type being the geometer, the 'geometer who is only a geometer' is incompetent to grasp the major problems either of science or of life. It follows that the logic of mathematics, far from being of universal application, gives us nothing of value even in mathematics, and that is because the real work of the mind is not conducted on mathematical lines at all. The mind works 'quietly, naturally, without art', not by means of 'definitions and principles'. Knowledge, that is to say, lies in immediate intuition and not in the machinery of mediation. It is no accident that the exponent of the 'reasons of the heart' was one of the great developers of the theory of probability. To Descartes, probability is the contradictory of knowledge; to Pascal there is no knowledge but probability.

## § 2

So far we have generality only, although amply illustrated by the whole trend of the *Pensées*. But Pascal's views on the method of science are fortunately available in systematic form elsewhere—in the various prefaces to his strictly scientific works and, more particularly, in the fragment 'De l'esprit géométrique'. If we turn to these minor essays we find the following points made:

(i) 'Ideal' demonstration uses terms only in one

defined sense and advances propositions only on the basis of truths already proved. But (ii) this true 'order' (of 'defining everything and proving everything') is impossible because its demands are self-contradictory. One is driven back always to primitive words which cannot be defined and primary propositions which cannot be proved. (iii) Geometry itself recognizes this difficulty and takes a 'middle way'. It demands a definition only for those things which are not clear and a proof only for those things which are not known. It hence falls short of ideal demonstration. (iv) Such measure of demonstration as is actually achieved by geometry is due to the simplicity of its objects and the precision of its definitions and proofs. But where such simple objects and such exact definitions are not available the same success cannot be expected. (v) This is the case in every sphere outside geometry itself. Ordinary words mean different things under different circumstances. 'The principle: *Je pense, donc je suis*, has not the same meaning in Descartes and in St. Augustine who said it twelve centuries before.' (vi) Logic, therefore, cannot follow the geometrical model. It may have borrowed the geometrical method and hoped for geometrical success, but the geometrical method is applicable only under geometrical conditions. The geometrician is trained in, and to, a false simplicity. He has learnt to reason correctly from first principles, but is at a loss when such principles are not available; nor is his insistence on the graduated

order of demonstration possible when the complexity of fact makes the intermediate steps infinite in number. Thus the geometrical intelligence is incompetent in the fields of morals and religion.

### § 3

This supremely interesting criticism centres in a twofold point. The so-called logical ideal of demonstration which is supposed to be exemplified in geometry is not exemplified even in geometry, and that because its requirements, being self-contradictory, are impossible of fulfilment at all. Geometry only *looks* as if it offered demonstration, and this appearance is due to the artificial simplicity of its subject-matter. But, if so, the whole geometrical ideal is valueless; even its pretensions cannot be imitated; the whole machinery of 'definition', 'deduction', 'demonstration' falls to the ground.

The failure of the geometrical method to cope with the actual world is seen most strikingly in the realm of physics, and indeed it is in connexion with the problems of physics (in the correspondence with Father Noël) that Pascal's epistemology was first elaborated. Side by side with a re-statement of the traditional geometrical order ('definition', 'axiom', 'proof'), we find an insistence on the necessity of comparing the deduced consequence with experience and, more remarkable, on the power of one negative instance to invalidate any hypothesis however much it had been verified otherwise posi-

tively.<sup>1</sup> The first of the two letters to Noël (October 1647) contains a specific reference to one such unfortunate hypothesis, that of the *matière subtile* of Descartes;<sup>2</sup> the second (1648) declares roundly that there is 'no necessary connexion between the definition of a thing and the assurance of its existence, and that one can define an object which is impossible as easily as an object which is true'.<sup>3</sup> We are thus thrust unceremoniously, for 'truth in the sciences', from the world of definitions to the world of experience.

This is true not only in idea, although Pascal's declarations are final enough—from 'dans la physique les expériences ont beaucoup plus de force pour persuader que les raisonnements' and 'les expériences sont les véritables maîtres qu'il faut suivre dans la physique' of the *Traité de la Pesanteur de la Masse de l'Air*,<sup>4</sup> to 'les expériences . . . sont les seuls principes de la physique' of the *Préface pour le Traité du Vide*.<sup>5</sup> But, such abstract statements apart, Pascal's own accounts of his famous experiments are set out in almost classic form as if in illustration of the methods of induction. His sense of the importance of the negative is fully Baconian. But these treatises are further remarkable for their special reliance on the method of 'concomitant variation', the method of experimental measurement *par excellence*.

<sup>1</sup> Pascal, *Œuvres*, ed. Strowski, i. 23, 27, 29.

<sup>3</sup> *Ibid.*, p. 35.

<sup>4</sup> *Ibid.*, pp. 95, 133.

<sup>2</sup> *Ibid.*, p. 30.

<sup>5</sup> *Ibid.*, p. 402.

## § 4

The further development and consequences of Pascal's view on the method of science<sup>1</sup> do not concern us here. It has been touched on only because it illustrates our position with regard to Descartes. The point I have tried to make in this essay is, in general, that made by Pascal, but I have added that it was realized by Descartes himself. The method of 'linear inference' did not only break down. Its collapse was apparent to its author. And its point of collapse was just that reference of principle to fact, of the possible to the actual, which constituted its own original claim and self-justification.

The end of Descartes' general metaphysical system was not so very different from that of Pascal. As I have tried to show elsewhere, it became a pluralistic atomism maintained by a theological voluntarism. The bridge constructed in the *Meditations* between the *Discourse* and the *Principles* had concentrated upon it all the accumulated difficulties of the logic and the physics, and the Deity, brought in to guarantee (as he was himself guaranteed by) our clear and distinct perceptions, was made to carry uneasily the discrete units of time, of simple intuitions and simple natures which make up the burden of an unintelligible world.

<sup>1</sup> e.g. the first part of Duhem's well-known *Théorie physique*; and cf. M. Brunschvicg's *Génie de Pascal* (Paris, Hachette, 1924), especially cap. 2, and Eastwood, *The Revival of Pascal* (Oxford: Clarendon Press, 1936).

But the unintelligibility springs from the very heart of Descartes' outlook in the method, and, at its baldest, is already displayed to view in the sixth chapter of the *Discourse*. The abstract reason, with its mathematical formulae, can apprehend nothing in a world which is essentially one of concrete determination.

## § 5

If the sum of this volume is to suggest that Descartes did not effect what he set out to do, his actual achievement is only the more firmly established. He set an ideal for science in an unescapable way, and if the marriage between physics and mathematics has in fact borne any fruit, it is due largely to his inspiration if not to his example. Tribute is still due to the dreamer of 1619 who gave Europe not only the ancient vision of Pythagoras but also the new instrument essential for its realization.

Yet the brilliant achievements of modern mathematical physics offer a problem, not a solution, to philosophy, and the scientist of to-day, bent on subordinating philosophy to his needs and methods, would do well to meditate on the history of Cartesianism. We have seen in Descartes that fusion of imagination and reason which marks the highest type of human intelligence; we have seen too the remorseless concentration which in any field is the source of human power. Descartes' flight

from a society he naturally adorned may not have been undertaken at the charge of a religious leader, but it was inspired by a passion of religious intensity.

Most seventeenth-century critics noted Descartes' evangelizing zeal: his was the conviction of a prophet and his desire was for disciples. But unfortunately for this purpose, although perhaps fortunately for the world, the dogmas in which he expressed his vision were almost immediately outworn. If Descartes had carried out his own programme and been luckier with his physical hypotheses, he would have been at most an inferior Newton.

As it was, the cherished physics proved a cul-de-sac, and Cartesianism, overspreading its own self-imposed limits, found other outlets for itself. The 'principles' revealed incidentally to base the 'discoveries' of natural science became an independent entity, and the system which struggled unsuccessfully to bridge the gap between universal formula and particular things took its stand finally on the revelation of the individual thinker to himself.

Yet the problems of the method remain. Is the unilateral deduction from first principles in truth the method of mathematics? Assuming it to be the method of mathematics, is it applicable to the problems of physics, and if to physics, is it to biology? And assuming it to be applicable to the problems of biology and 'natural' philosophy, is it applicable to metaphysics, or philosophy as such? Descartes gave



an affirmative reply to all these questions as one. Herein lay his vision; herein, too, the problem he bequeathed to posterity.

## § 6

The *Discourse*, as we have seen, came into its own with the discredit of the *Essays*: the stone rejected of science became the corner-stone of philosophy. Yet this is not to the shame of philosophy. The science of the seventeenth century (and who can explain that century of genius?) was in some measure prophecy rather than science; and inspiration, which is a poor substitute for fact, is one of the major stimulants to reflection. The formulae of Descartes, like the trumpet-calls of Bacon, suggest problems which go beyond themselves, and it is no matter for wonder that, for all the expressed views of their authors, they rose above the petty business of controlling nature to our ends. After all, as Voltaire remarks, 'les inventions les plus étonnantes et les plus utiles ne sont pas celles qui font le plus d'honneur à l'esprit humain'.

We have here an instance of a universal truth. Scientific knowledge soon grows out of date. What to one generation is new and important is to the next either false or commonplace, and the discoveries which revolutionize the mechanics of living are often scandalously casual. How trite to us is the theory of the circulation of the blood which fills a whole (and the only dull) chapter in the *Discourse*, and

how right is Descartes in commenting<sup>1</sup> on the incidental character ('à la honte de nos sciences') of the discovery of optical lenses. But philosophical inquiry remains what it was, and we are still agitated by the problems which agitated a Plato or a Descartes. The *Discourse on Method*, shorn of the *Essays* to which it is a prelude, shorn of its fifth chapter on physiology, shorn even of that essential portion of its title which gives meaning to the word 'method'—the *Discourse* remains as a record of the self-revelation of the human spirit in one of its many paths to truth. But whether truth lies even in a 'revised version' of the *Dioptric*, *Meteors*, and *Geometry* is another question entirely.

<sup>1</sup> *Dioptrique* I (vi. 81, ll. 19 ff.).