FOUNDATIONS OF OBJECTIVE KNOWLEDGE

The Relations of Popper's Theory Of Knowledge To That Of Kant

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CHAPTER 1

POPPER'S VIEWS OF KANT'S PROBLEM

When Popper was very young, and read Kant's first *Critique* for the first time, he found it much too difficult, was "struck and puzzled by the queer arrangement of the Antinomies", and could simply not "understand what Kant . . . might mean by saying that reason can contradict itself" (*Autob.*, 12). Despite these difficulties, however, he could see that the book was about real problems. Although he later complained about Kant's obscure style, which "contributed considerably to a further lowering of the low standard of clarity in German theoretical writing" (OS, *2*, 38), he saw immediately, from his first readings, that Kant was different from the verbalist philosophers, who abandon "real problems for the sake of verbal ones" (*Autob.*, 12). He saw through the opacity of Kant's language that Kant's problem was not a pseudo-problem (CR, 93), not a linguistic puzzle (94), but an interesting and inescapable problem (93), or a "problem which could not be dismissed" (94). Kant's obscurity, then, was not for Popper of that kind he attributes to incompetence, or to the attempt to impress people by words (*Replies*, 977). In his *mottoes* to the 'Preface' of *Logik der Forschung*, Popper contrasted Schlick's remark that "philosophy will never get so far as to pose a genuine problem" with Kant's contrary assertion that "whenever a dispute has raged for any length of time, especially in philosophy, there was, at the bottom of it, never a problem about mere words, but always a genuine problem about things" (LSD, 13). Later, he contrasted Hume's prediction that "because of the remoteness and abstractedness and practical irrelevance of some of his results, none of his readers would believe in them for more than an hour", with Kant's contention "that the problem 'What can I know?' was one of the three most important questions a man could ask" (CR, 4; see KRV, A 815/B 833).

But what was the problem which according to Popper was "not previously seen by anyone else" (CR, 184), but which was seen by Kant with perfect clarity (189), indeed "more clearly than anyone before or since"? In his 1933 manuscript on *Die beiden Grundprobleme der Erkenntnistheorie* Kant's problem is divided in two, namely, the problem of induction, identified as the problem of the first *Critique's* Analytic, and the problem of demarcation, identified as the problem of the *Critique's* Dialectic (GE, 17). In his

letter of the same year to the editor of *Erkenntnis*, Kant's problem is identified as the problem of demarcation (LSD, 313), and in the 1934 original *Logik der Forschung*, we read: "If, following Kant, we call the problem of induction 'Hume's problem', we might call the problem of demarcation 'Kant's problem' " (LSD, 34). In the same book, Kant is taken by Popper as having formulated a principle of induction, in the guise of a principle of universal causation. According to Popper, Kant thought that principle to be *a priori* valid, in his attempt to force his way out of the difficulties of the matter, namely, the vicious circles of inductive justifications of principles of induction (29). In connection with these brief remarks no reference was made by Popper to any specific passage of Kant's texts. But commenting upon the same remarks in his 'Conjectural Knowledge: My Solution to the Problem of Induction' (1971), Popper did refer to a passage of the *Prolegomena* where Kant, according to Popper, called "the problem of the existence of *a priori* valid statements 'Hume's problem' " (OK, 4n7). Popper then reiterated his view that Kant had taken the principle of induction as *a priori* valid. And Popper added that this view "contained hints of an important historical interpretation of the relationships between Kant, Hume, and the problem of induction".

It should have been noticed at once, of course, that what Kant was calling Hume's problem, in the passage Popper had in mind, was the problem of the impossibility of deducing from experience the concept of cause and effect (*Prol.*, 9/10), and not the general problem of establishing the existence of *a priori* valid statements. Popper later acknowledged (1972) that is was not the problem of induction that Kant had called 'Hume's problem' (OK, 85), and admitted that in the passage of the *Prolegomena* to which he had previously referred Kant had "originally introduced the name 'Hume's problem' for the epistemological status of *causation*". Yet at the same time Popper insisted that Kant had then generalised the name – 'Hume's problem' – "to cover the whole question whether synthetic propositions could be valid *a priori*" (*id.*). Such a view of Kant's problem is stated by Popper in many places (LSD, 29; OK, 27/8, 86, 91/2 GE, 60 etc.), being at one point characterised as follows: "Kant's problem 'How can synthetic statements be valid *a priori*?' ", Popper writes, "was an attempt to generalise" the traditional problem of induction in either of its following formulations: "How can a principle of induction (that is, a *non-logical* principle justifying induction) be justified?", or "How can induction be justified (in spite of Hume)?" (OK, 27/8). In order to explain why, in his view, Kant had attempted to solve such a problem, Popper analysed Kant's problem-situation.

Kant's problem, Popper writes, "arose out of the contemporary situation in science" (CR, 93). In Kant's time, Newtonian science was almost universally accepted. There was, in Popper's view, an understandable, seemingly well-founded belief that Newton's theory *must* be true (185), a belief shared by all who were knowledgeable in the field, to the point that it was rightly felt that Newton's critics "had somehow missed the point of the theory" (93): "No qualified judge of the situation could doubt any longer", Popper asserts, "that Newton's theory was true". Yet Hume, who was soon to interrupt Kant's dogmatic slumber (*Prol.*, 9), had, in Popper's view, rightly and convincingly "taught that there could be no such thing as certain knowledge of universal laws, or *episteme*" (CR, 94). It was against this situational background that, according to Popper, Kant was "the first philosopher clearly to apprehend" the riddle of experience, or the paradox of empirical sciences (190), namely: empirical science is indeed knowledge, but is not logically derivable from empirical observations. In a time when everybody believed that Newton's laws were derived from experience by induction (93), "Kant saw more clearly than anyone before or since how absurd it was to assume" such a derivation (185), hence that "the history of science had refuted the Baconian myth that we must begin with observations in order to derive our theories from them" (189). Kant's riddle, or paradox, was, therefore, that though confirmable by observations, Newton's laws transcended all observations, and could not, for logical reasons, have been derived from observations (190). This is paradoxical because, according to Popper, Kant believed that *the* method of science was the method of induction. Now, the problem of induction arose, in Popper's view, "from a mistaken solution of the problem of demarcation" (*Autob.*, 41). The mistake was "the belief that what elevated science over pseudoscience was the 'scientific method' of finding true, secure, and justifiable knowledge, and that the method was the method of induction" (*id.*; also GE, 60).

Up to this point, then, Popper's view of Kant's problem could be summarised as follows. Kant tried to solve the problem of the limits of scientific knowledge, or the problem of demarcation. This is, according to Popper, Kant's problem *par excellence*, and would have become, with Kant, "the central problem of the theory of knowledge" (LSD, 34). But Kant would have interpreted his problem as the problem of finding a criterion for true, secure, and justifiable knowledge, because he believed that only such a Knowledge could be called 'science' (see also RS, 55; OU, 47 & n1). And Popper explains this alleged belief of Kant's as a consequence of Kant's acceptance of the incontestable truth of Newtonian science. Popper attributes

an extreme importance, in fact, to Kant's alleged acceptance of Newton's authority. Among all the assumptions which Popper believes to have been made by Kant in the formulation of his problem this was, in Popper's view, the only one which was really wrong and the one which was the source of the rest of Kant's errors, namely, the error of having believed empirical science to be *episteme*, and the error of having believed *the* method of science to be inductive. With the remaining Kantian assumptions, as Popper isolated them, *e.g.* the assumption that Newton's theory could not have been derived from observation, Popper was in full agreement. (This was, of course, Kant's view as *Popper* understood it, not Newton's: see Newton 1962, Book III, 338/40, 398, 406/15 etc.). Popper believes that so much actually hinged on Kant's erroneous, alleged assumption that Newton's theory was incontestable, that Popper went as far as to say that it had been that assumption "which prevented Kant from being a critical rationalist" (CR, 27). The whole trouble, according to Popper, was due to the mistaken assumption that knowledge implies truth (*Autob.*, 87; CR, 94), but this assumption is taken by Popper as a consequence of the acceptance of Newton's authority (CR, 26). Had not Kant accepted the incontestability of Newton's theory, Popper seems to think, he would probably have been able to conceive of knowledge as belonging to a realm other than that of *episteme*. As a consequence of this, according to Popper, Kant would not have been led, in the face of Hume's results on induction, to formulate his problem as Popper took it to be, that is, as the problem of explaining Newton's physics as a pure, *a priori*, natural science.

Popper thinks that, though the problem of demarcation was Kant's problem *par excellence*, the real problem Kant was facing was the logical problem of induction, which Popper reconstructed as arising from the apparent clash between the following assumptions: "(a) Hume's discovery . . . that it is impossible to justify a law by observation or experiment . . .; (b) the fact that science proposes and uses laws . . . (c) the principle of empiricism which asserts that in science, only observation and experiment may decide upon the acceptance or rejection of scientific . . . laws and theories" (CR, 54). Now, since Kant believed, according to Popper, that the method of science was inductive, but realised that for logical reasons Newton's theory could not have been derived from observations, Kant interpreted his original problem of demarcating empirical science as *episteme*, as the problem of finding a non-logical, or aprioristic justification for induction. This is the real problem which appears, in Popper's view, under the mask of Kant's attempt to account for the possibility of synthetic *a priori* judgements. For Popper,

Kant misconceived the logical problem of induction as the problem of how to substitute an *a priori* inductive principle for the principle of empiricism. "Assuming that empirical knowledge was obtainable by induction, and at the same time impressed by Hume's criticism of induction", Kant, Popper thinks, "suggested that we had to adopt some principle of induction, which in turn could not be based on induction" (*Autob*., 87; in fact Popper is here referring to B. Russell's arguments, not Kant's; but he added that he attributed to Kant precisely these arguments, since in his view Russell's position was in this respect identical to Kant's).

Popper's views of Kant's problem are mistaken in several important points: Kant did not want to demarcate *empirical* science, but, rather, to set *metaphysics* upon the path of a science (KRV, B xxiii); it is *metaphysics* that Kant wanted to identify with *episteme, not* empirical science, which was for him fallible and conjectural; his strictures on induction are at least as severe as those of Hume, and transcendental conditions of possibility have nothing to do with principles of induction. The extent of Popper's misunderstandings will become clear in the course of the following chapters, when my reconstruction of Kant's philosophy is developed. But I will now already advance a few comments on Popper's views, if only to indicate the directions in which those views will in due course be contrasted with my own.

To begin with, Popper's view of Kant's problem as virtually identical with his own, that is, as the problem of demarcating empirical science from all the rest, including mathematics, logic, and metaphysics (LSD, 34), though supported by the fact that Kant was, among other things, searching for a "criterion by which to distinguish with certainty between pure and empirical knowledge" (KRV, B 3), is-nevertheless very misleading. For, if Kant wanted to demarcate anything, then he wanted to demarcate metaphysics, as the science of, *not* empirical, but *a priori*, pure, certain, necessary, and universal knowledge (A vii *passim*, B xxiii, A 4/B 8, B 19 *passim* etc.).

Popper's view that, according to Kant, Newtonian science could not be derived from experience is also misleading. According to Kant, physics had a pure and an empirical part. Gravitational attraction, for example, can be for Kant either a regulative idea of reason (KRV, A 663/B 691 *passim*), or an inductive generalisation from experience (MAN, 212), or, in its pure part, a principle of pure natural science, which Kant carefully distinguished from Newton's physics (MAN, 147). (For Kant's theory of regulative reason, see 4.2. *below*. For Kant's strictures on induction, see 4.1. *below*. And see Buchdahl 1969a, 672n3, for the correct analysis of the example of gravitational attraction.) As part of pure natural science, gravitational attraction

inductive generalisation. That Popper missed the point of Kant's transcendental method is also attested by Popper's frequent mistakings of transcendental for genetical, psychological, or even logical *a priori* (*Autob.*, 46; CR, 48), and also by his comparisons of Kant's transcendental apparatus, or of Kant's idea of a spontaneous understanding, to a physiological digestive mechanism (RS, 154; OK, 342). To sum up what will have to be argued, in detail, in the course of the following chapters: Just as it would be absurd to hold that Kant, in the Analogies, for example, was attempting to prove *a priori* that the world (the real, that is, the phenomenal world) is full of substances causally interacting in space-time, so it is absurd to hold that Kant, in the transcendental deduction, was attempting to prove *a priori* that there is lawfulness, or there are laws, under all circumstances ("*daß es unter allen Umständen 'Gesetzmäßigkeiten' geben muß*", GE, 69). But this is what Popper takes Kant to have attempted to do. And, after admitting that Kant did not use 'deduction' in 'transcendental deduction', in the sense of logical deduction (60), Popper proceeds to treat Kant's transcendental deduction as precisely a logical proof (Sec. 10, 69 *passim*), blended with conceptual analysis. No wonder Popper ends up by finding Kant's deduction inconclusive (GE, 76) and question-begging (*Autob.*, 59). But Kant's deduction is, of course, neither analytical (experience could not be objective only because objectivity is part of the concept of experience), nor empirical, or synthetic *a posteriori* (that experience is objective could not be inferred from experience). We will come back to Popper's rendering of Kant's transcendental deduction when we examine Popper's problem as a revision of that of Kant, in the next Chapter.

Popper thinks that the central problem of Kant's first *Critique* was, beside demarcation and the aprioristic justification of induction, the problem of the possibility of a pure natural science, 'natural science', meaning, for Kant, 'Newtonian science' (CR, 94). This is also mistaken. Popper advances two reasons why he believes that every time Kant used the expression 'natural science', he had in mind 'Newtonian science': the first reason is that Kant would have given an *a priori* deduction of Newtonian science, in the *Metaphysical Foundations of Natural Science*. But Kant did no such thing (see 6.1.3. *below*). The second reason is that Kant's reference to the starry heavens at the end of the second *Critique* (KPV, 162), was a reference to Newton's cosmology. But Kant was in fact referring, by 'starry heavens', to the order of the natural laws of the universe, as contrasted with the order of the moral law in ourselves, hardly to Newton's cosmology as such. At any rate, the problem of the first *Critique* was, indeed, the possibility of

synthetic *a priori* judgements, as is well known, and not pure natural science. No doubt *one* of the aims of that work is to establish the common pure part of *any* particular science, but this was not its central aim, and Kant left the examination of the possibility of pure natural science to the *Metaphysical Foundations of Natural Science*.

Popper notices that Kant's riddle was not exclusively related to natural, or Newtonian science: "Kant also showed that what holds for Newtonian theory must hold for *everyday experience*", namely, everyday experience too transcends observation, interprets observation, operates with abstract ideas such as that of cause and effect (CR, 190). This might have led Popper to distinguish between Kant's problem of scientific knowledge (Newtonian or not), solved by Kant's theory of regulative reason, or of transcendental-*subjective* principles, on the one hand; and Kant's problem of the objectivity of experience (scientific or not), solved by Kant's theory of regulative and constitutive understanding, or of transcendental-*objective* principles, on the other hand. But Popper conflates the two problems. Kant's question, "How is science possible?" is for Popper just another way of asking, "How are human minds able to gain grasp of the world?" (CR, 325). For Kant, however, each of those questions correspond to a distinct problem. Better: the first question was in fact asked by Kant in at least *four* distinct senses, of which one, but only one, corresponds to the second question. Let us see which these senses are.

In the first sense, "How is science possible?" means for Kant "How can we construct successful scientific theories?" This is the problem of finding a metaphysical rationale for the context of discovery and was formulated by Kant in the Dialectic of the first *Critique*, being further developed in the two Introductions to, and the Second Part of, the third *Critique*. In the second sense, "How is science possible?" means for Kant "How can our scientific theories be tested by experience?" This is the problem of finding a metaphysical rationale for the context of justification and was formulated by Kant in the Aesthetics and the Analytic of the first *Critique*. In the third sense, "How is science possible?" means for Kant "How can mathematics apply to the experienced world?" This is the problem of finding the relation between *the given* (physical existence) and *the necessary* (the result of mathematical construction) and was formulated by Kant in several places of his pre-critical and critical works (see Chapter 3 *below*). In the fourth sense, "How is science possible?" means for Kant "How can we guarantee a (scientific) realist interpretation for Newtonian physics?" This is the problem of finding the relation between transcendental-objective principles of

understanding (either constitutive, or regulative) and the *metaphysical core* of Newton's Cosmology, and was formulated by Kant in the *Metaphysical Foundations of Natural Science*. The first of these problems was solved by Kant's theory of transcendental-subjective principles of regulative reason; the second, by his theory of transcendental-objective (regulative and constitutive) principles of understanding; the third, by his revision of the received view of the methods of analysis and synthesis; and the fourth was *not* solved, for it is insoluble, *as Kant himself admitted*.

If the central problem of the first *Critique* – the problem of the synthesis *a priori* – unfolds itself into two, then these are the problem of the objectivity of ordinary experience and the problem of discovery of *empirical* – not pure – natural science. On the one hand, Kant clearly saw that empirical science needed an objective empirical basis; on the other hand, he clearly saw that, since empirical scientific theories are underivable from experience, no matter how objective such an experience is, we needed to be guided in empirical theory construction by regulative ideas. But, *above all*, Kant also saw very clearly that the two problems must have *independent* solutions. If empirical laws of nature were determined by transcendental laws of understanding, then there could be no real world, independent of our minds. If transcendental laws of understanding were determined by empirical laws of nature (the naturalistic solution), then there could be no *questio juris* to be asked. In both cases, knowledge does not make sense. So Kant says that "Nature [the aggregate of all appearances] submits to our understanding in its purely formal [transcendental] laws (by which it is the object of experience in general), but in respect to the plurality and heterogeneity of the special empirical laws *it is free from all restrictions legislated by our cognitive faculty*" (*First Intr.*, 16). The nature that is free from the understanding's constraint *is the object of empirical science* (see 4.2. *below*). If there could be a strictly empirical account of how we can learn from experience, that is, of the objectivity of the ordinary experience which must constitute the empirical basis of science, then we would be for ever trapped in a circle, for the strictly empirical account itself could not be said to be objective.

When Popper sees not one, but three problems, as the object of Kant's concerns, he describes the problem of the validity of Newtonian theory as Kant's second problem (CR, 81), the first being the cosmological one, together with the problem posed by the antinomies. This might have led Popper to realise that Kant was not exclusively concerned with *Newton's* theory, but with theoretical knowledge in general. For it is mainly in the

first *Critique*'s Dialectic, where the cosmological problem and the problem posed by the antinomies are dealt with, that Kant developed his theory of the regulative employment of reason and, thereby, the metaphysical rationale for our scientific theory construction. However, by interpreting Kant as solely concerned with *Newtonian* science – besides being concerned with everyday experience (CR, 190) – and not with empirical science in general, Newtonian or not, Popper ends up by conflating Kant's problem of empirical, scientific knowledge with Kant's problem of experience in general (of the objectivity of ordinary experience). But the former was solved by transcendental *subjective*, while the latter was solved by transcendental *objective* principles; the former principles are exclusively *regulative*, the latter, regulative (Analogies, Postulates) and *constitutive* (Axioms, Anticipations); the former principles rule *reflexive*, the latter, *determinant* judgements; the former belong to reason's *analytic* dimension, the latter to its *synthetic* dimension (see Chapter 3 *below*). These distinctions are vital for the understanding of Kant's philosophy and they seem to have been ignored by Popper (see, for instance, GE, 72, where Popper hits at Kant's notion of a regulative principle, but at the same time misses the point, regarding *Als-Ob-Gesetzmäßigkeit* as *a posteriori* and incompatible with the synthetic *a priori* turn of the transcendental deduction). It was Buchdahl's merit to have discovered, beyond Kant's ambiguous use of 'knowledge' (meaning either theoretical knowledge or cognitive grasp), 'nature' (meaning either the appearances or the system of empirical laws), 'law' (meaning either transcendental or empirical law) etc. the two major dimensions of Kant's theoretical philosophy, namely that of reason, and that of the understanding (see Buchdahl 1965, 1967, 1969a, 1969b, 1971, 1980). Though the distinction between the regulative and the constitutive in Kant's philosophy had been acknowledged in Kantian scholarship for long, only with Buchdahl's interpretation could it be illuminated in all its consequences. But this will have to be left for Chapters 4 and 5 *below*.

What will be examined in the following Chapter is how far Popper's own problems can really be regarded – as Popper regards them – as resulting from a revision of those of Kant. After what has already been said above, however, I hope it is already clear at least that the Kantian problems which were allegedly revised by Popper were Kant's problems as Popper saw them, and not exactly Kant's problems as I think they appeared to Kant himself.

CHAPTER 2

POPPER'S PROBLEMS AS A REVISION OF THOSE OF KANT

As we saw in the previous Chapter, in Popper's view, Kant's basic error was to assume that science was *episteme*, or that knowledge implies truth (*Autob.*, 87; CR, 94), this assumption being, in turn, a consequence of Kant's alleged acceptance of the absolute authority of Newton's cosmology (CR, 26 etc.). Now, taking into consideration Kant's problem-situation as Popper reconstructed it, such an error was, in Popper's view, quite unavoidable and very little to be reproached (190). Yet, Popper goes on, it rendered Kant's problem insoluble (94). Without the assumption of the incontestable truth of Newtonian science, Popper maintains, *Kant's problem* "How is pure natural science possible?" *collapses*, and "the most disturbing of his perplexities disappears" (*id.*). Indeed, with hindsight, Popper came to think that his own critical rationalism and critical empiricism, *precisely by revising that particular, erroneous assumption*, put the finishing touch to Kant's critical philosophy (26/7). Kant, he says, "the great discoverer of the riddle of experience, was in error about *one* important point" (190, my italics). "But", he adds, "this error . . . was quite unavoidable, and detracts in no way from his magnificent achievement" (*id.*).

Well, since the erroneous assumption that Popper attributes to Kant was, of all others, precisely the one which depended most on Kant's particular historical circunstances, it should be expected that what stirred Popper himself from his own slumbers and drove him to his revision of Kant should have been some counterpart feature of his own, new problem-situation. And indeed it was: Kant's error was unavoidable, he says, "that is, before Einstein" (CR, 191). A significant factor in Popper's problem-situation was the challenge to Newton's theory presented by Einstein's theory of gravitation, and Eddington's 1919 eclipse observation, which corroborated Einstein's theory. From the point of view of Einstein's, Newton's theory was, in Popper's words, "an excellent approximation, though false" (*Replies*, 979, 1151). It was Einstein's theory which led Popper to the philosophy of science (979), that is, which led him to undertake his revision of Kant's problem. It was Einstein's achievement that in Popper's view "freed physics of the paralysing belief in the incontestable truth of Newton's theory". "Thanks to Einstein", he remarks, "we now look upon this theory as a

RS, Chapter II). The inclusion of Newton's theory in the latter question is a clear indication that Popper was not looking for a criterion of demarcation between true and false theories. The formulation of his problem, even in the above simple form (CR, 34), already presupposes his substitution of fallibilism for Kant's alleged infallibilism. Only on such an assumption could it have begun to dawn on him that it was precisely the fact that Marx's, Freud's and Adler's theories were always confirmed, which constituted, not their strength, but their weakness (35).

Even less was Popper concerned to distinguish science from pseudo-science on the grounds of the meaningfulness or meaninglessness of their respective statements. This was one of the grossest misunderstandings of Popper's demarcation criterion and Popper has always been at pains to sort out the whole issue, having repeatedly written about its origins and the story of its dissemination. For the purposes of this book, however, I think I need not extend myself on this matter. Let me only point out that Popper frequently formulated his problem in terms of drawing a line of demarcation between *statements* (LSD, 313; CR, 255, 39). But he was not concerned, in this context, with their meaning, but rather with their content, that is, with their consequence classes. It is only in a narrow sense, anyway, that Popper's problem of demarcation should be seen as the problem of distinguishing scientific, empirical statements, or even theories, from the metaphysical ones. Popper's aim later evolved to be much broader than this. He now sees as his aim to distinguish the highest forms of scientific enquiry (that of Galileo, Kepler, Newton, Einstein – *Replies*, 977/8), not only from pseudo-scientific ones (those of Marxism, Freud, Adler), but also from other, lesser forms of scientific inquiry: "My criterion of demarcation between science and non-science", he now maintains, "is a simple logical analysis of [a]picture of science in [its] heroic sense" (*id.*). That is: "I do not count among [science's workers] those for whom science is no more than a profession, a technique: those who are not deeply moved by great problems and by oversimplification of bold solutions" (977).

The path which led Popper to the complete formulation and subsequent dissolution of the problem of induction also started with Kant. Just as he supposed Kant had done, Popper approached the problem of induction through Hume (CR, 42), and saw it as Hume's problem *par excellence*. Just as it was by revising what he took to be Kant's infallibilist assumption that Popper was led to his fallibilist principle, so it was, he says, in the light of Kant's analysis of the problem of knowledge, as Popper interpreted it, that he was led to his complete rejection of induction:

> Induction, Hume has shown, was invalid because it led to an infinite regress. Now, in the light of Kant's analysis (and my rejection of *a priori* valid synthetic statements) I was led to the formulation: induction is invalid because it leads either to an infinite regress or to apriorism (OK, 86).

By 1929, however, Popper had already realised that, on the one hand, the solution to the *problem of induction* should also provide us with a solution to the problem of demarcation (*Autob.*, 61), perhaps because the former was only an aspect, instance, or facet of the latter (CR, 54); and, on the other hand, that the fallibilist principle alone, being just an assumption of the *problem of demarcation*, could not provide us with its complete solution. A complete solution depended, in turn, of the solution of two other, subordinate problems, namely, the *problem of method* and the *problem of progress*. The former consisted in finding out if scientific discovery should be entirely relegated to the psychologist – or perhaps to a mysterious poetic vein of ours (CR 192) – or if it had a logic of its own, to which logic its psychology should be subordinate; the latter problem consisted in explaining how could *conjectural* knowledge progress towards the truth, or how are successful conjectures possible (95). Whereas the problem of induction required a negative solution, the problem of demarcation required a positive one. And all the four problems, of induction, demarcation, method, and progress, result, for Popper, of revisions of Kant's problems. The problem of progress, in particular, either in its formulation as contained in the question, "How are successful conjectures possible?" (95), or in "How is it possible that experience counts?" (RS, 174), or yet in "How is it possible rationally to argue for or against a conjecture?" (71, 86), is presented as a problem that Kant *should* have formulated, and its answer, an answer that should be given in the spirit of Kant's Copernican Revolution (CR, 95).

It was again by combining his ideas with those he took to be Kant's, or by reinterpreting Kant, that Popper could finally complete the lengthy process of his change of interest from the psychology to the logic of discovery. After reading Kant's first *Critique* again and again, Popper decided to express Kant's central idea (*Autob.*, 46), by Kant's famous *dictum* (which Popper quotes without reference): "The understanding does not draw its laws (*a priori*) from nature, but prescribes them to nature" (*Prol.*, 82), and which he interpreted as meaning that "scientific theories are man-made" and that "we try to impose them upon the world" (*Autob.*, 46). It so happens, as we shall see at length, that Kant is not in his *dictum* referring to scientific, empirical laws, but, rather, to transcendental laws of understanding; not to nature as the object of scientific investigation (the system of laws), but

to nature as the appearances. Nature as the system of empirical laws is for Kant "free from all restrictions legislated by our cognitive faculty" (*First Intr.*, 16; see the previous chapter and 4.2. *below*). But Popper simply did not realise this. The same *dictum* is quoted (this time, with reference) in his *Postscript* to *The Logic of Scientific Discovery*, and this time Popper's interpretation is somewhat fairer to Kant. "We owe to Kant", he writes, "the first great attempt to combine a realistic interpretation of natural science with the insight that our scientific theories are not simply the result of a description of nature – of 'reading the book of nature' without 'prejudice' – but that they are, rather, the products of human mind" (RS, 3). And there follows the quotation of Kant's *dictum*, from the *Prolegomena*. But again, this is a fair rendering – though only partial, incomplete – *of Kant's theory of regulative reason*, and not a correct interpretation of Kant's *dictum*, which has somehow deeply impressed Popper. He says he tried to "improve this excellent Kantian formulation" (RS, 3), combining it with his own ideas, having arrived as a result, to his own solution to the problem of progress (*Autob.*, 46). In his summary of this solution, emphasis is put upon a specific feature of the process of growth of knowledge, namely, that its critical, or scientific phases are necessarily preceded by an uncritical, or dogmatic one (*id.*). And this corresponds, incidentally, with Kant's account of the phases through which, *not* scientific knowledge, as Popper understands it, but metaphysical knowledge progresses: "The first step", says Kant, "in matters of pure reason, marking its infancy, is dogmatic. The second step is sceptical"; and the third step is the criticism of reason (KRV, A 761/B 789). This parallel, however, was not drawn by Popper. Instead, he proceeded to acknowledge that Kant had been "right to believe that knowledge was genetically or psychologically *a priori*" (*Autob.*, 46). But Kant, of course, has never believed any such thing: Kant has emphatically rejected either the psychological interpretation of the transcendental *a priori* (as if it were constituted by subjective dispositions of thought, KRV, B 167), or the biological one (as if it were a kind of preformation system of pure reason, *id.*). "*This*", he says, "*is exactly what the sceptic most desires*" (B 168). But Popper will not only reduce transcendentality to psychology, or biology, but *also* to logic, the formal logic Kant called general, carefully distinguishing it from the transcendental one. Kant's errors had not been, in Popper's view, quite as crude as (CR, 48) a failure "to distinguish between psychologically *a priori* ways of thinking . . . and *a priori* valid beliefs" (47), for "the expectation to find regularities is not only psychologically *a priori*, but also logically *a priori* (48). Popper here misses the distinction between

general and transcendental logic, speaks nonsense, from Kant's point of view, for nonsense would be for Kant the talk of *factual* (psychological or biological) aprioricity, and is again very unfair to Kant, who has never admitted that an *a priori* judgement could be reduced to a belief. No wonder Popper could go as far as to hold that our inborn, instinctive expectation of finding regularities, which is psychologically *a priori*, "corresponds very closely to the 'law of causality' which Kant believed to be part of our mental outfit and to be *a priori* valid" (47). For Popper, neither knowledge, nor expectations to find regularities are, of course, *a priori* valid, for they may fail. And not having realised that they may fail was, in Popper's view, Kant's alleged, infallibilist error. Now, if this is so, Popper concludes, "then what I originally regarded as the psychology of discovery had a basis in logic: there was no other way into the unknown, *for logical reasons*" (*Autob.*, 47, my italics). Such was Popper's reinterpretation of Kant, closely connected with Popper's "change of interest from the psychology of discovery to an objectivist epistemology – that is, to the logic of discovery" (43).

Thus, Popper's problem, as a revision of that of Kant's, could perhaps be briefly stated as the problem of finding a criterion of demarcation for empirical science, embodying conjectural, as opposed to Kant's certain, knowledge, and thereby finding a non-aprioristic, as opposed to Kant's aprioristic, explanation of scientific method and of scientific progress. If Popper's revision of Kant's problem were such a simple and straightforward matter, we might even conclude our analysis of it at this point, by saying that in Popper's view Kant took for granted the incontestable truth of Newtonian science, and aroused from his dogmatic slumber by Hume, ended up by giving his aprioristic formulation of the problem of scientific knowledge; whereas Popper himself, in his turn, taking for granted what he thought to be Kant's problem itself and, aroused from his own slumber by the Einsteinian Revolution, ended up by giving his evolutionary formulation to what was structurally a very similar problem. But this would be Popper's version of the story, and matters are objectively much more complicated than this, for Popper's view of Kant's problem is mistaken, and yet there are important affinities between them, independently of what Popper thinks of Kant. We shall see, for example, in 4.3., 5.2.3., 5.2.4. and 6.2.2. *below* that Popper's theory of knowledge is even closer to that of Kant's than Popper himself ever realised, but for reasons unsupected by Popper.

Popper likes to compare his theory of knowledge with a searchlight (OS, *2*, 260), by contrast with what he calls the passivist theories of knowledge (213/4), bucket theories of science, or bucket theories of the mind

(OK, 341/2). He is referring here to the classical contrast between the mind as a *tabula rasa* and the mind as the seat of innate ideas (in Popper's theory, biological analogues of ideas). Popper avoids these classical labels because he wants to emphasise the active aspect of the mind whilst classical innatism could also have a passivist interpretation, in some aprioristic sense. Activity, in Popper's evolutionary approach, means interaction between organism and environment. Popper calls the adepts of passivist theories strict empiricists (OK, 342), and takes Kant as having opposed them, by holding that "we must most actively engage ourselves in searching, comparing, unifying, generalising, if we want to attain knowledge" (OS, *2*, 214). If this is not for Popper to be an activist, then I do not know what Popper means by activist. *Yet* Popper also regards Kant's view as a special brand of passivism, even more radical than that of Bacon's, the difference lying in that Bacon talked about the pure wine of experience, whilst Kant's wine is fermented by something akin to digestion (OK, 341/2). Popper's view that Kant is after all in the same bucket together with Bacon – and even more deeply sunken into it than Bacon – is very difficult to reconcile with Popper's view that according to Kant we must most actively engage ourselves in the activity of knowing. Since the latter view was published in 1945, and the former in a lecture given in 1948, it is not impossible that Popper changed his mind in that interval. But the view of Kant as an activist is much more consistent with Popper's having taking him as his ally against positivism (LSD, 105n3) and pure empiricism (OS, *2*, 214 and OK, 342). Be that as it may, Popper rejects both passivist and activist theories of knowledge as inadequate (OK, 342), though he admits that Kant's view "might be so interpreted that it comes much nearer" to his own view than does pure empiricism (*id.*). Kant' errors, then, were not only to have believed that knowledge implies truth or that *the* method of science was the method of induction, or that empirica science was *episteme*, or that Newton's cosmology was incontestable, or that the latter could be deduced *a priori* from the laws of the understanding, but also that "it was possible to discover the one true and unchanging categorial apparatus" (OS, *2*, 214), and that the searchlight itself was incapable of improvement (361/2). By contrast, Popper's searchlight theory of science contains "just those elements of Kantianism that are tenable" (*id.*).

My version of the whole story is of course very different. I think Popper attributed to Kant errors that Kant did not commit – at least in the sense Popper thinks he did. Popper overlooked important aspects of Kant's theoretical philosophy. Then Popper revised, or corrected alleged errors of Kant's and, in some cases, took as the results of his revisions what in fact have always

idea of the self-critical constraint of reason, from the field of ethics to the field of philosophy of science. Such an extension, however, is again a kind of unwitting correction of yet another misunderstanding: there was no need to extend Kant's attitude here, for Kant's critical rationalism was not restricted to the employment of reason in ethics. Kant maintained that:

> Reason must in *all* its undertakings subject itself to criticism; should it limit freedom of criticism by any prohibitions, it must harm itself, drawing upon itself a damaging suspicion. Nothing is so important through its usefulness, nothing so sacred, that it may be exempted from this searching examination, which knows no respect for persons. Reason depends on its freedom for its very existence. For reason has no dictatorial authority; its veredict is always simply the agreement of free citizens, of whom each one must be permitted to express, without let or hindrance, his objections or even his veto. (KRV, A 738/9-B766/7; my italics).

Besides failing to appreciate the real scope of Kant's critical rationalism, Popper interpreted Kant's doctrine of the autonomy of practical reason as a doctrine of the primacy of an irrational decision (OS, *2*, 353n6), that is, a decision stemming from an irrational faith in reason (231): ". . . the teaching of . . . Kant could be interpreted as approaching 'critical' rationalism. (I have in mind [his doctrine] of the 'primacy of the will', which may be interpreted as the primacy of an irrational decision)" (353n6). "Kant", Popper maintains, "was right . . .": ". . . although there is no 'rational scientific basis of ethics', there is an ethical basis of science, and of rationalism" (238). Such an interpretation is of course *apparently* supported by the fact that Kant did find it "necessary to deny knowledge, in order to make room for faith" (KRV, B xxx). But, in fact, Kant was here referring to the knowledge of transcendent – as opposed to transcendental – objects. On the one hand, nothing was further from Kant's intentions than to deny that we may achieve pure and *a priori*, metaphysical knowledge of the *transcendental* rules of understanding and of reason. On the other hand, one of the consequences of Kant's denial of our ability to achieve *transcendent* knowledge was precisely his transformation of the transcendent objects of reason into regulative ideals, for the conjectural pursuit of empirical, theoretical, scientific knowledge. Kant went as far as to make it his aim to confirm the truth of the first *Critique* "in the *two* fields, of speculative and of practical reason" (KRV, B xliii, my italics). The metaphysical grounds of our experience in general, of our theoretical knowledge of nature, and of our knowledge of morality must for him be reconciled by being understood as emanating from one and the same source, namely, human reason: "there is", he says, "an absolutely necessary *practical* employment of reason – the moral" (B

xxv). But: "Though [practical] reason ... requires no assistance from speculative reason, it must yet be assured against its opposition, that reason may be brought into conflict with itself" (*id.*). That practical reason does not require assistance from speculative reason does not mean that for Kant "there is no 'rational scientific basis' of ethics", as Popper interpreted it, but, at most, that there is no scientific basis of it. And even less does it mean that Kant admits any kind of primacy of an irrational decision, for Kant was a rationalist in both the domains of the interests of reason, the theoretical and the practical. What could be argued against Kant's critical rationalism is not that it was not critical enough, and needed to be extended to epistemology and philosophy of science, but, rather, that it was too critical, in the sense that Kant seems to have ignored the impossibility of a comprehensively critical rationalism (see Watkins 1971 and Popper's OS, *2*, 238 and *Replies*, 1196n213).

But it is not only by correcting Kant's belief philosophy and Kant's uncritical attitude in philosophy of science that Popper manages both to misinterpret Kant *and* to attribute to himself genuine Kantian doctrines. I examined above the cases of belief and of criticism in some detail, because I do not intend to come back to these matters in what follows. But even in connection with aspects of Kant's theory of knowledge that will be examined in detail in the following Chapters, it is worthwhile at least to point out here the other instances of the *quid pro quo* that is at the very origin of Popper's theory. We saw above, just to set another example, that Popper attributes to Kant the correct insight that knowledge is logically, psychologically, and genetically *a priori* (*Autob*, 46; CR, 47/8). By doing so, Popper seems to have entirely missed the significance of Kant's transcendental solution to the problem of our cognitive grasp of an objective world (Chapter 5 *below*). Being transcendental, Kant's *a priori* is neither logically, nor psychologically, nor genetically *a priori* (supposing, *per absurdum* that there is a sense in which we could talk of *factual* aprioricity). The transcendental *a priori* cannot for Kant be logically *a priori* because it is constitutive, that is, determines the kind of object that can, and the kind of object that cannot, be given in experience, *or* it is regulative, that is, guides either reason itself or the understanding. By contrast, logic is for Kant purely formal, it determines nothing regarding the objects of experience (KRV, A 50/B 74 *passim*, B ix), can only be a canon, but not an organon of knowledge (L, 15) - that is, cannot explain how a specific knowledge can be achieved. The transcendental *a priori* cannot for Kant be either psychologically, or biologically *a priori*, because it is necessarily *a priori*, and not contingently *a priori*, as

psychological and genetic *facts* must be. Besides, as we saw above, and will see below, Popper's interpretation of Kant's *a priori* was ruled out by Kant himself (KRV, B 167/8), as a kind of anticipation of the evolutionary approach to epistemology. By interpreting Kant's transcendental account of experience in general as an account of the possibility, not of the objectivity of ordinary experience, but as an intended account of the possibility of empirical science, Popper has entirely missed Kant's conjecturalist approach to theoretical knowledge (Chapter 4 *below*). By reinterpreting what he took to be Kant's infallibilist approach to empirical science as a fallibilist one, Popper unwittingly hit at an important aspect, already present in Kant's philosophy, that is, Kant's conjecturalism, but which Popper took, not as Kant's, but as a result of his reinterpretation of Kant.

The *quid pro quo* has several other instances. Popper claims to have revised Kant's alleged belief that induction was *the* method of science. Yet Kant does not accept that an inductive principle play the role of a premiss in deductive argument, thereby justifying inductive generalisations. Moreover, inductive confirmations are for Kant of little importance, being replaceable with advantage by scientific testing-procedures based on the *modus tollens* (4.1. *below*). Popper claims to have revised Kant's apriorism, that is, Kant's alleged attempt to justify induction by means of *a priori* principles. Yet Kant is an empiricist, not a pure empiricist, but an empiricist nevertheless. And he might well have subscribed to Popper's Principle of Empiricism, according to which in science only observations and experiment may, in the end, decide upon the fate of our theories. Indeed, for Kant, "in experimental philosophy . . . the final means of deciding . . . must in the end be supplied by experience" (KRV, A 425). Moreover, the qualifications that Kant might have added to Popper's principle are remarkably similar to those Popper himself adds to it, namely, that any decision taken on the basis of observations and experiment is revisable (see Chapter 3 *below*), that there are no criteria of empirical truth, and that observation and experiment are theory-laden (see L. 55; *First Intr.*, 6; and 4.1. *below*). Popper claims to have revised Kant's alleged infallibilist doctrine that "our quest for knowledge must necessarily succeed" (CR, 47/8, 95). Yet not only scientific knowledge is for Kant hypothetical, inconclusive and conjectural, but also when there is no quest for knowledge in the sense of scientific inquiry, that is, in ordinary experience, Kant is, as I have already pointed out, as fallibilist as Popper, *with the difference* that, for Kant, science has an objective basis, whereas Popper holds that the empirical basis of science has no foundation whatsoever. Kant has provided a rationale, *not* for our

establishing rock-bottom, incorrigible basic statements, but for their *objectivity*, that is, for the possibility that, in the process of correction of our basic judgements, our experiences can count as *reasons* for our acceptance or rejection of them. And the rationale Kant provided for such an objectivity is *independent* of any scientific theory (e.g. a causal theory of perception), so that the fate of the latter can in the end be decided on the basis of observation and experience, *without circularity*. By contrast, Popper, who formulated *the problem of progress* as contained in the question "How is it possible that experience counts?" (RS, 174), and presented it as the question Kant *should* have formulated (CR, 95), fails to solve it, by his reluctance to provide a rationale for the objectivity of ordinary experience. Popper's failure has led him to the uncomfortable position (see 5.2.2. *below*) of having to admit the basically pragmatic, conventionalist, and sociological character of our decisions regarding the acceptance or rejection of test-statements, an admission not at all in line with Popper's own critical rationalism, empiricism, and objectivism. Popper claims to have revised Kant's alleged idealistic doctrine (see 6.2.2. *below*) that scientific theories are our inventions, restricting it by means of the alleged anti-Kantian qualification that our scientific theories are tested against a reality that is not man-made. Yet for Kant reality is *not* man-made. On the contrary, we shall see that Kant's theory of knowledge is conjecturalist because, among other things, natural appearances are for him "objects which are given to us independently of our concepts, and the key to them lies not in us and our pure thinking but outside us" (KRV, A 480/B 508).

Let us now pause to reconsider Popper's alleged reinterpretation, or revision, described above, of Kant's famous *dictum* that the understanding does not draw its laws from nature, but prescribes them to nature. I have already pointed out that Popper's interpretation of that passage of Kant is mistaken, and that we shall elaborate Kant's senses of 'nature', 'law' and 'experience' in 4.2. *below*. But since Popper took that passage as a turning point for his revision of Kant, it is worth noting that Kant's *dictum* is immediately preceded by the following statement: "We must distinguish empirical laws of nature, which always presuppose particular perceptions, from the pure or universal" – Kant means transcendental – "laws of nature, which without having particular perceptions as their ground merely contain the conditions of their necessary unification in an experience. In respect of the latter, nature and possible experience are exactly the same . . ." (*Prol.*, 81/2). When Kant says that "the understanding does not draw its laws (*a priori*) from nature, but prescribes them to nature", he means that the

understanding does not draw its transcendental rules from nature in general (the appearances), but prescribes them *a priori* to it, so that they, in combination with empirical intuitions, enable us to have a cognitive grasp of an objective, but physically contingent, world (Chapter 6 *below*). Now, in Popper's *interpretation*, Kant's *dictum* implies not only "that our reason attempts to impose laws upon nature, but also that it is invariably successful in this" (CR, 191, 95; RS, 152/3; Popper really thinks that these laws are the Newtonian ones: see OU, 48). Indeed, in Kant's transcendental sense, the prescription of rules by the understanding to empirical intuition could not be described as an attempt and, except in cases of illusion, cannot fail, in the same sense that scientific theories may fail. In Popper's *reinterpretation*, however, Kant's passage *should* read as follows: "Our intellect does not draw its laws from nature, but tries – with varying degrees of success – to impose upon nature laws which it freely invents" (CR, 191; RS, 3). But, then, if we substitute 'invents, according to regulative reason' for 'freely invents', in Popper's revision, we get a fair rendering of, not Popper's, but *Kant's* conjecturalist theory of empirical knowledge, according to which the understanding cannot determine any empirical law of nature, and these laws must be sought for by scientific inquiry, under the guidance of the regulative principles of reason. In *this* sense, our prescription of laws to nature is, for Kant, tentative and fallible. As I will argue later, it is not the understanding itself, but reason, while reflecting the understanding, that conjecturally and regulatively prescribes, that is, demands – but never determines – that nature, as a system of empirical laws, be ordered according to a purposive unity (4.2. *below*). The role of the understanding is here to hold a mirror to reason (Buchdahl 1971, 30), and such senses of 'law' and 'nature' are, for example, very much in line with Kant's doctrine, already mentioned above, that in respect to its empirical laws, nature is "free from all restrictions legislated by" the understanding (*First Intr.*, 16; Chapter 1 *above*). Popper's imposition interpretation is, thus, mistaken, and that which Popper thinks that should be put in its place is already there, in Kant's philosophy itself. So Popper claims to have revised what was in need of no revision. For the only laws our minds impose upon nature (appearances), according to Kant, are the transcendental laws of understanding, which is *silent* about the empirical laws of nature (the object of scientific investigation), which empirical laws cannot, for Kant, be cognised *a priori* (see *First Intr.*, 18 and KU, 20).

Both Popper and Kant wanted to challenge scepticism, without making too many concessions to uncritical dogmatism. But neither did Kant concede

not only to show how in the end he was led to impose a kind of transcendental turn to his evolutionary approach, regarding the problem of the empirical basis, but also to show how, in the context of discovery, his meta-conjectures regarding the kind of truth we ought to pursue, the causal structure of the world, its uniformity, or its intelligibility (4.2. *below*) are genuinely metaphysical, regulative principles, in the sense of Kant's transcendental-subjective ones. And to say regulative is, of course, to say non-inductive. Without a powerful regulative idea such as the idea of verisimilitude, Popper's meta-conjectures regarding the method of conjectures and refutations cannot be sustained as *rational*: all that we would then have the right to say about them is that they are factually explicable. Even Popper's realism (6.2. *below*) could be better defended if Popper adopted the Kantian doctrine – which he, in fact, unwittingly adopts! – that to provide a rational account of the progress of empirical knowledge we must postulate an independent source of it, and a source which, precisely because of its independence, must remain forever unknown as it is in itself. Only then would Popper's conception of reality gain force, within his radically fallibilist epistemology, according to which no conclusive refutation of a theory can ever be achieved; and only then would his interpretation of "Kant's doctrine of the impossibility of knowing things in themselves as corresponding to the forever hypothetical character of our theories" (*Autob.*, 65) really make sense.

Sorting out Popper's misinterpretations of Kant is not, however, my main purpose in this book. Even establishing the objective relations that do exist between Popper's and Kant's philosophies, independently of what Popper thinks of them, is only a means to achieve my main aim, which is to make a case for (critical) foundationalism and objectivism in theory of knowledge, as contrasted with all forms of naturalism and relativism. Popper's relations to Kant are, however, exemplary: Popper's objectivist theory runs into trouble because he is simply not Kantian enough. Not that Kant's transcendentalism is the ultimate solution to all epistemological problems, of course. But it is surely the best way available to show that we can be objectivists and realists, even though there are no such things as ultimate solutions.

CHAPTER 3

A RECONSTRUCTION OF KANT'S PROBLEM

3.1. SETTING THE STAGE: A BRIEF NOTE ON DOGMATIC METAPHYSICS

One of the problems philosophers were trying to solve in the seventeenth and eighteenth centuries was the old problem of finding a rational explanation for our knowledge of natural phenomena. Such knowledge was then conceived, by most philosophers, as expressible by mathematical, functional, law-like relations, which, more than mere regularities, seemed to reflect the physical necessity of external relations between bodies and their states. Classical rationalists and empiricists alike had, however, realised that, if the ontological ground of natural necessity could be found at all, then it had to lie in a realm other than natural phenomena themselves.

The idea that the ultimate explanation of appearances could not be found among appearances themselves, but had to lie at some non-sensible, deeper level of reality, goes back to the early Greek, natural philosophers. The process by which phenomena appear, disappear, or transform themselves, was then ultimately explained by the *physis*, the explanatory entity, but at the same time principle, whose true nature was variously identified, e.g. with the elements, with an *apeiron* etc.

All the primitive accounts of the *physis* had in common, however, the explanation of phenomena in terms of a governing *arche*, at the same time the archaic, but in itself eternal origin of all temporal appearances, and their archetypal, or ideal *logos*. It was from this double nature of the *physis* that the ontological (the archaic, later the *ratio essendi*) and the epistemological (the archetypal, later the *ratio cognoscendi*) elements of ultimate explanations were gradually distinguished one from the other, through a lengthy philosophical history.

The deep source of the above model of explanation was surely the need to find a *ratio*, a common measure, or proportion, that could make the order of sensible, ephemeral appearances, in irreversible time, commensurable with the intelligible, eternal ideas, in the reversible order of thought. Just as the conclusions of a logically valid reasoning, though coming later than its premisses in the temporal order of its development, were thought to

have ever been implicit in the premisses, in the non-temporal order of logic, so that which unfolded itself in space-time could perhaps be accounted for, by analogy with the logical order, as if it were somehow inherent in that which preceded it. Plato's description of the origin of time is one classical example of this search for a common measure between the temporal and the eternal:

> Now the nature of the ideal being was everlasting, but to bestow this attribute in its fullness upon a creature was impossible. Wherefore he resolved to have a moving image of eternity, and when he set in order the heaven, he made this image eternal but moving according to number, while eternity itself rests in unity; and this image we call time. (*Timaeus*, 37d; Plato 1978)

Among the possible heuristic procedures that might analogically mirror, in the temporal order of our thought-processes, the reversibility of premisses and conclusions, the mathematical method has always been regarded as the most adequate. If the irreversible order of phenomena were to be made rational, or intelligible, then it had to be expressed mathematically. The method of natural philosophy had, then, somehow, to reflect mathematical heuristics itself, as, for example, in the form attributed to Pappus.

Pappian heuristics is a twofold procedure. "In analysis", it is recommended, "we suppose that which is sought to be already done, and we inquire from what it results, and again what is the antecedent of the latter, until we on our backward way light upon something already known and being first in order" (Hintikka and Remes's translation; see their 1974, 8). In what is perhaps already a departue from the original intentions of the geometers, and because that "something already known and being first in order" cannot be considered the uniquely possible premiss, analysis was traditionally interpreted as a method of testing conjectures: "If you have a conjecture, derive consequences from it. If you arrive at a consequence known to be false, the conjecture was false" (Heath 1925, *1*, 138/9). "In synthesis, on the other hand, we suppose that which was reached last in analysis to be already done, and arranging in their natural order as consequents the former antecedents and linking them one with another, we in the end arrive at the construction of the thing sought" (Hintikka and Remes's translation; 1974, 9). Again, in what Hintikka and Remes would consider the Aristotelian, directional and propositional interpretation, this was traditionally rendered as follows: 'If you arrive at a consequence known to be true, reverse the order and, if the [original] conjecture can be thus derived from this true consequence, then it was true' (Heath 1925, *1*, 138/9).

"When analysis and synthesis were later thought of as two separate methods", Hintikka and Remes remark, "this is often a sign that the analogy with the Greek geometrical analysis and synthesis is being forgotten or at least somewhat loosened" (Hintikka and Remes 1974, 17). Indeed. But no matter how superficial and possibly mistaken is the traditional view, it was this view that was held by those who attempted to *apply* the method of analysis and synthesis to the newborn, natural sicence, as Galileo's use of *resolutio* and *compositio* attests (107).

Descartes is very explicit about this matter: "The manner of demonstration", he says, "is twofold: one proceeds by analysis *or resolution*, and the other by a synthesis *or composition*" (*Replies to Objections*, II). *Method* in general, for him, "consists entirely in the order and arrangement of those things upon which the power of the mind is to be concentrated in order to discover some truth. And we will follow this method exactly if we reduce complex and obscure propositions step by step to simpler ones and then try to advance *by the same gradual process* from the intuitive understanding of the very simplest to the knowledge of all the rest" (*Regulae ad Directionem Ingenii*; Descartes 1964, 163, my italics). One of the tenets of dogmatic metaphysics was precisely the presumption that it was somehow possible to get in contact with *absolute truth*, at the end-point of analysis, that is, at the starting-point of synthesis. It is from there, from that priviledged, Archimedian point, that the world should be reconstructed by synthesis.

Analysis was in that time *associated* (not identified) with induction, and synthesis with deduction. But, then, as Lakatos has aptly pointed out, "in a psychologistic theory of logic (such as Galileo's, Descartes's or Newton's) . . . there need be no difference between a content-increasing and a content-non-increasing inference", and "the difference between deduction and induction was not clear" (Lakatos 1978b, 101; see also Buchdahl 1969a, 341 and 341n4). The scientific analysis of empirical concepts into its properties was usually believed to be possible, much in the analogous sense in which it is possible to dismantle a machine, or dissect an animal. And the scientific synthesis of thoughts was usually taken to be possible, just as it is possible to produce a technological synthesis of artifacts, or a chemical 'synthesis' of matter. Thus, for Newton, it was quite natural to say that as in Mathematics, so in Natural Philosophy, the (distinct) method of analysis ought ever to precede the (distinct) method of synthesis, analysis being experimental and inductive, synthesis the deduction of phenomena from established principles (*Opticks*, Query 23/31; Newton 1952, 404/5; see

Buchdahl 1969a, 338/39, 341n4; for the Newtonian conception of induction, see Newton 1962, II, 548, 398/400).

Analysis was usually taken, through the seventeenth and eighteenth centuries, as the methodological path leading from facts to theories; synthesis, from theories to facts. Analysis was thought to proceed from the unknown to the known, or from the relative to the absolute; synthesis, from the known to the unknown, or from the absolutely certain (at least in Descartes's sense) to the relatively certain. The way of analysis was thought to go from the empirical, or empirically known, to the rational, or rationally known; synthesis', from the rational to the empirical. What really mattered in analysis was confirmation; in synthesis, proof. Whereas analysis proceeded by experiments, synthesis proceeded by systematization, or embedding the results of analysis into wider theories. Analysis was essentially subtraction, or abstraction; synthesis, addition or construction. Analysis reduced complexes, like complex experiences, to its simple constituents; synthesis reconstructed those complexes from those simples. Analysis was a regress to the simple, that is, the simplest to understand, intuitively, though the most difficult to identify; synthesis, a progress from the simple to the complex.

The attempts to apply this kind of alleged mathematical heuristics to empirical science, that is, the efforts to provide a rational account of the method of empirical science *by analogy* with what was then *taken* as the original, mathematical heuristics, were bound to fail. Though Descartes affirmed that synthesis should retrace the analytical steps by "the same gradual process", he was aware that this could not really be achieved, for he emphasized that the result of analysis was of a different order from the point of departure of synthesis: the simple, for him, "must be regarded in a different manner when we are concerned with its relationship to our knowledge of it [*ratio cognoscendi*], than when we speak of it in reference to its actual existence [*ratio essendi*]" (*Regulae*, XII). In a word: it could not be a natural, straightforward matter to derive principles from the phenomena, and then retrace our path, by the same kind of steps, in order to deduce the now explained, or intelligible phenomena, from those principles.

It took a very long time, however, before the nature of the above difficulty could be fully understood. I think the difficulty was fully understood, for the first time, by Kant. But until Kant, the ontological and the epistemological elements built into the original Greek model of ultimate explanation—by means of a double natured *arche* were not as sharply distinguished as it would be necessary for the avoidance of dogmatic fallacies, such as the postulation of metaphysical, explanatory entities, as if their existence

physical significance or reference to any physical reality, whist at the same time being capable of 'accounting for' observable phenomena." Buchdahl (1969a, 288; see Newton 1952, 368/9; 1962, 235, 244, 300/1, 419 etc.)

For Hume, the recourse to God, or to the postulation of metaphysical, explanatory entities, as the ultimate ground of natural phenomena, seemed *at first sight* to be finally ruled out (*Inquiry*, Section IV, part II). But the fact that for Hume a metaphysical ground could not be found, or a rational account be given, either of the existence of the external world, or of the necessary connections between certain events, does not mean that he did not seek "to learn the foundation" of the inductive inferences, that, according to him, we in fact make (*id.*). In fact, he was prepared "to allow that there may be several qualities, both in material and immaterial objects, with which we are utterly unacquainted" (*Treatise*, I, III, 14); that "the operations of nature are independent of our thought and reasoning" (*id.*); and that "like objects may be observed, in several instances, to have like relations" (*id.*). Indeed, Hume observes "that nature has established connections among particular ideas . . ." (*Inquiry*, V, II), and he goes as far as to refer to this fact as "a kind of pre-established harmony between the course of nature and the succession of our ideas", though adding that "the power and forces by which the former is governed be wholly unknown to us" (*id.*). He never doubted, however, that whatever satisfied his eight "Rules by which to Judge of Causes and Effects" (*Treatise*, I, III, 15), was really a cause, *quâ* perception of the mind. He was never contented with an analysis of the idea of cause merely in terms of spatio-temporal contiguity and succession, though such attributes were for him "essential" to causes and effects (I, III, 2), but went, instead, as far as to remark that "there is a *necessary connection* to be taken into consideration", which is for him "of much more greater importance than any of the other two" attributes above mentioned (*id.*). He believed that we always infer inductive conclusions, and justly so: "a man is guilty of unpardonable arrogance who concludes", he says, "because an argument has escaped his own investigations, that therefore it does not really exist" (*id.*). And this holds not only for arguments, but for causality as well (see Buchdahl 1969a, Chapter VI, 332, 335, 344, 373): we can thus see, Buchdahl remarks, "the wrongheadedness of the impression often given that Hume did not 'believe in causation' buy only 'constant conjunction'. Such a judgement is the denigration, indeed, of all Hume stood for, which was that *a quality or relation is not removed just because no metaphysical foundation for it can be produced*." (381, my italics).

For his *foundational* questions concerning induction, Hume finds the

following answers: all our reasonings concerning matters of fact are founded on the relation of cause and effect; all our conclusions concerning the relation of cause and effect are founded, in turn, in experience; and, finally, all our conclusions from experience are founded on the supposition that the future will be conformable to the past (Inquiry, IV, II):

> If there be any suspicion that the course of nature may change, and that the past may be no rule for the future, all experiences become useless, and can give rise to no inference and conclusion. It is impossible, therefore, that any arguments from experience can prove this resemblance of the past to the future, since all these arguments are founded on the supposition of that resemblance.

Why we then conclude, Hume asks, "that such particular causes must necessarily have such particular effects, and why we form an inference from one to another?" (*Treatise*, I, III, 3) "What is our idea of necessity, when we say that two objects are necessarily connected together?" (I, III, 14) "What is the medium, the interposing ideas which join propositions so very wide of each other?" (*Inquiry*, IV, II. See the illuminating Section 9 of Chapter 6 – 374–385 – of Buchdahl's 1969a, for the interpretation of these questions.) "The idea of necessity", Hume argues, "arises from some impression. There is no impression conveyed by our senses which can give rise to that idea. It must, therefore, be derived from some internal impression, or impression of reflection", for the "repetition of perfectly similar instances can never *alone* give rise to an original idea, different from what is to be found in any particular instance . . ." (*Treatise*, I, III, 14). But what could be such an internal impression? For this *psychological* question, Hume finds the following answer: there is an analogy between natural science and human nature; our supposition that the future will be conformable to the past – on which supposition alone, as we have just seen above, are founded, not only our conclusions from experience, and concerning the relation of cause and effect, but also all matters of fact – is itself founded on a kind of attraction between different ideas, "which in the mental world will be found to have as extraordinary effects as in the natural, and to show itself in as many and various forms" (I, I, 4). It is *this* that, in the end, will be called by Hume 'custom' or 'habit' (*Inquiry*, V, I).

Such was the situation of metaphysics in Kant's time. Reductions of sensibility to intellect, or of intellect to sensibility were dogmatic resources, taken in the quest for certainty. The reduction of physical being to extension, figure, and motion, was associated with the postulation of explanatory faculties, such as intellectual intuition, or explanatory principles, such as

pre-established harmony, or occasional causes. The ultimate guarantee of a presumptive access to absolute truth was a Creator, truthful, or all-perceiving God, at least once identified with nature itself, and even replaced, by Hume, by a postulated gravitational attraction between ideas. In all this, the distinction between ontological and epistemological *ground* was nearly lost. "Once entitled the Queen of all sciences", Kant writes, metaphysics had turned itself, after all methods had been tried and found wanting (KRV, A x), into an object of scorn (A viii), weariness and indifferentism (A x). Such was the metaphysics Kant wanted to reform and restore, by turning it into a new science. He thought he could thereby sever the "roots of materialism, fatalism, atheism, free-thinking, fanaticism, and superstition", idealism and scepticism (B xxxiv), as well as silence for ever "the source of all unbelief . . . which wars against morality" (B xxx), and "all objections to morality and religion" (B xxxi).

The reform and restoration of metaphysics required, according to Kant, the development of a new method, and a new interpretation of the method of analysis and synthesis. As he stated explicitly, he attempted to alter the procedure which had until his time "prevailed in metaphysics, by completely revolutionising it" (B xxxii). He attempted to write the first *Critique* as a treatise on this new method, as a propaedeutic (B 25) to a future system of metaphysics (B xxxvi), or to "the system of all principles of pure reason" (B 27). Since the business of metaphysics, for him, "is to extend our *a priori* knowledge" (B 18), he wanted to discover "a method entirely different from any hitherto employed, at least to bring to a prosperous and fruitful growth a science indispensable to human reason", that is, "a science whose every branch may be cut away but whose root cannot be destroyed" (B 24).

It is by keeping in mind Kant's aims, as he stated them, that in the following parts of the present Chapter I will reconstruct his problem-situation. By 'problem-situation', in Kant's case, I mean certain questions arising out of the situation of metaphysics, mathematics, and natural philosophy, in his time. We can surely find in Kant's theory of knowledge several traces belonging to each of the rationalist and empiricist doctrines, briefly mentioned above, but transformed by Kant's critical approach, though none beyond recognition (see Buchdahl 1969a).

3.2. THE ORIGINS OF KANT'S PROBLEM

Kant had before him, we saw (3.1.), in the philosophy of his time, a succession of ultimately unsuccessful attempts to find a rational explanation for