

CONTEXT OF DISCOVERY AND CONTEXT OF JUSTIFICATION

I. Introduction

MANY discussions that have been carried on between philosophers of a more "positivistic" and those of a more "historicist" orientation about fundamentals have centred around the famous distinction between the so-called context of discovery and the context of justification. This fact can be easily understood. For the positivistic tradition, taken in a wide sense that includes logical empiricism and critical rationalism, the distinction provided the very foundation of philosophy of science. The distinction seemed to guarantee that philosophy of science is an autonomous enterprise, independent of other disciplines that address the sciences from different angles. Furthermore, the distinction guided philosophy to those aspects of science that were indeed capable of philosophical reflection, namely, the sciences taken as a body of knowledge.

In opposition to the "positivists", philosophers of a more historicist orientation believed that the isolation of philosophy of science from the more empirical disciplines like history, psychology and sociology of science was extremely harmful. But a demonstration that a collaboration between philosophy and those disciplines might prove fruitful and even necessary seemed completely blocked by the context distinction. In light of this distinction, everyone who argued for such a collaboration simply missed the point of what philosophy of science is all about. Consequently, the philosophers of the historicist orientation felt compelled, in order to legitimize their philosophical child, to argue against the distinction between the two so-called contexts.

At least in the nineteen sixties and the seventies there was probably a consensus between both parties that "the distinction between the context of discovery and the context of justification is a major focal point for any fundamental discussion of the relations between history of science and philosophy of science".¹ But the discussion between more positivistic and more historicist philosophers was far from successful. In fact, it became so hopeless that Herbert Feigl, who belongs to the pro distinction camp,

*Philosophisches Seminar, Universität Zürich, Rämistrasse 71, CH-8006 Zürich, Switzerland
Received 28 March 1986; in revised form 22 November 1986.

¹Salmon (1970), p. 70.

confessed that he was “dismayed by the amount of — it seems almost deliberate — misunderstanding and opposition to which this distinction has been subjected in recent years”.² Yet he noted that the attacks came from “such brilliant and knowledgeable scholars as N. R. Hanson, Thomas Kuhn, Michael Polanyi, Paul Feyerabend, Sigmund Koch *et al.*”.³

The situation in the nineteen eighties is unclear, however, since it seems that history of science is generally being taken more seriously by all philosophers of science, and not only by those within the historicist camp. But agreement on the distinction between the contexts has never been reached, at least not publicly and explicitly. Rather, the interest in the distinction seems somehow to have faded away, without a real resolution of the earlier disagreement. In this situation it seems worthwhile to look back in an attempt to understand the unsatisfactory course the context distinction controversy has taken up till now.

It seems, therefore, that the controversy about the so-called context distinction is somehow confused. An important source of confusion is that the context distinction contains at least four or five different though related distinctions, and I will explain these distinctions in Section III. Consequently, the seemingly homogeneous context controversy will turn out to consist in a number of fairly heterogeneous controversies (Section IV). Finally, some consequences from our discussion will be drawn (Section V). I will start with some remarks on the earlier history of the distinction in question, before Reichenbach brought it to prominence.

II. Historical Remarks

Many writers trace the distinction between the context of discovery and the context of justification back to Reichenbach's *Experience and Prediction* of 1938. This is probably correct insofar as the English terms “context of discovery” and “context of justification” are concerned.⁴ But the distinction may easily be traced back further, finding distinctions which are nowadays conflated under the one distinction between contexts. I shall not go into the respective historical details, but I shall return to the differences in drawing the distinction in the next section.

Popper makes use of the distinction in his 1935, where he ascribes it to a remark in discussion by Reichenbach.⁵ The distinction is basic to Popper's *Logik der Forschung* of 1934.⁶ Further back, the distinction can be found in the programmatic *Wissenschaftliche Weltauffassung — Der Wiener Kreis* by

²Feigl (1970a), p. 4.

³Feigl (1974), p. 2.

⁴Reichenbach (1938), pp. 6–7.

⁵Popper (1935), p. 170; Reichenbach (1935), p. 172.

⁶Popper (1934), chapter I, section 2.

Carnap, Hahn and Neurath of 1929,⁷ in Carnap's *Aufbau* of 1928,⁸ and in Schlick's *Allgemeine Erkenntnislehre* of 1918.⁹ It can also be found in the second edition of Husserl's *Logische Untersuchungen* of 1913,¹⁰ in Frege's *Grundlagen der Arithmetik* of 1884, and even earlier in his *Begriffsschrift* of 1879.¹¹ In the neo-Kantian literature the distinction can be found, for instance, in Cohen's *Prinzip der Infinitesimalmethode* of 1883.¹² In the methodological tradition of the 19th century the distinction can be found in Whewell's *Philosophy of the Inductive Sciences* of 1847,¹³ and it was introduced, according to Losee, by J. Herschel in his *Preliminary Discourse on the Study of Natural Philosophy* of 1830/31.¹⁴ One may go back even further to Kant.¹⁵ Some writers trace the distinction back as far as Aristotle and Euclid.¹⁶

Most of these authors considered their respective versions of the distinction to be fundamental, and some of them even used it to define the legitimate field of philosophy as set apart from other disciplines. The main impact on the discussion about the so-called contexts in the philosophy of science of our century has been, however, the character given to the distinction by Popper, and, somewhat differently, by Reichenbach. In the last few decades, most writers on the subject, both proponents and opponents, have followed their lead in the way they introduce the distinction.

III. The Distinction as Introduced by its Proponents

This section will address the subject matter of the distinction under consideration. In other words, in what domain does the distinction draw a dividing line?¹⁷ It is obviously not helpful to state that it is a distinction between "contexts" since this is far too vague.¹⁸ The general neglect to clarify

⁷Carnap/Hahn/Neurath (1929), chapters II and III.2.

⁸Carnap (1928), § 100.

⁹Schlick (1918), e.g. pp. 2–3, 7, 13, 14, 37–38, 92–93.

¹⁰Husserl (1913), vol. II/1, introduction, § 7. Even the term *Begründungszusammenhang*, commonly translated as "context of justification", can be found in the *Logische Untersuchungen*, specifically, in vol. I, § 6 (also in the first edition of 1900).

¹¹Frege (1879), preface; Frege (1884), § 3.

¹²Cohen (1883), chapter I, sections 6 and 7.

¹³Whewell (1847), vol. II, pp. 20–21.

¹⁴Herschel (1830/1831), p. 164; Losee 1972, pp. 115–120. For some information on the historical background of the introduction of the distinction in the methodological tradition see Laudan (1980).

¹⁵Popper traces the distinction back to Kant's *quid juris* – *quid facti* distinction in the *Critique of Pure Reason* (A84/B116): Popper (1934), chapter I, section 2; see also Feigl (1964b), p. 46. One may also draw on Kant's opposition of epistemology to empirical psychology in the *Prolegomena* (§ 21a).

¹⁶Feigl (1970a), p. 4; Blackwell (1980), p. 91.

¹⁷Compare the following with a related discussion in Nickles (1980b), pp. 8–18; see also Chmielecka (1982), pp. 63–64.

¹⁸Compare Feigl's statement that "this widely used terminology [of contexts] is perhaps not the most felicitous" one [Feigl (1970a), p. 4].

the subject matter of the distinction has led to confusion that permeates most of the controversial discussion surrounding it. At least four or five different distinctions are combined in this one distinction. Of course, this is not to say that every proponent of the context distinction conflates all four or five distinctions, nor that the combination of different distinctions in the one context distinction is simply a mistake. Rather, the combination results from certain fundamental philosophical presuppositions. Let me now turn to different components of the context distinction.

(a) *Processes*

A common way of introducing the distinction is by distinguishing two types of historical processes, namely, the process of the discovery and the process of the justification of this discovery. Furthermore, these processes are frequently characterized as taking place one after another, which seems necessary since any justification requires the existence of that which it justifies.¹⁹

(b) *Process of discovery vs methods of, or reconstruction of, or analysis of, or considerations relevant to justification or to critical testing.*

This distinction is a variation of the previous distinction. Instead of taking the actual historical process of justification as the counterpart of the actual historical process of discovery, the “methods of justifying”, the “rational reconstruction” or the “analysis” of justification, or the “considerations”, “items”, or “factors” that are relevant to an attempt to justify or to test critically are taken as counterparts. Thus the present distinction is a distinction between the factual and the normative.²⁰ A number of subdistinctions could be made but they are irrelevant to our present concerns.

One may note some ambiguity in the distinction just given. The methods, etc. of justification or of a critical test at a specific point in time in the past are not distinguished from the methods that would be appropriate according to present or “eternal” standards. This ambiguity will be dealt with in connection with the next distinction.

(c) *Analysis of discovery as empirical vs analysis of justification or of critical testing as logical*

This distinction is partly a variation and partly a special case of the last one between the process of discovery and the methods, etc. of justification. The previous distinction is usually drawn in preparation for the present

¹⁹ See e.g. Popper (1934), chapter 1, section 2.

²⁰ See e.g. Feigl (1970a), p. 4; Popper (1934), section 2; Reichenbach (1938), section 1; Salmon (1970), pp. 68, 72; Salmon (1973), section 3; Scheffler (1967), pp. 69–73; Siegel (1980a), pp. 299–304; Siegel (1980b), pp. 369–372.

distinction.²¹ The specification is that the considerations, factors, methods etc. of justification or of critical testing are determined to be logical ones. "Logic" is to be understood here in the sense of 20th century deductive or inductive logic as opposed to classical, transcendental, or Hegelian logic. The study of a particular discovery, however, is, in a broad sense, an empirical enterprise. It may involve historical, psychological, and sociological reasoning and research but not logical methods, for allegedly the process of discovery is not subject to any logical principles.

This specification presupposes that the above-mentioned ambiguity between an actual historical justification/test and a justification/test according to present or to "eternal" standards does not exist. If the methods, factors, considerations, etc. of justification and test are ultimately based on formal logic alone they are independent of time. Hence, what counts as a justification or critical test at some point in time counts as such at any point in time.

(d) *Philosophy of science vs history, psychology and sociology of science*

Intimately connected with the last distinction between the process of discovery and the methods of justification is the distinction between academic disciplines that are fundamentally different in their methodological character. Philosophy of science is seen as addressing the logical analysis of justification or critical testing, whereas history, psychology, and sociology of science are empirical disciplines.²² This is not to say that philosophy and these disciplines should be practiced in total independence from each other.²³ But the dependence can only be unidirectional. The empirical disciplines have to learn from philosophy of science what a justification or a critical test consists of in order to know what is in need of an empirical explanation. But philosophy of science cannot learn anything from the empirical disciplines since what counts as justification or as critical testing is solely a question of logical reasoning. The correctness or incorrectness of a particular justificatory procedure can be determined by logical reflection alone and by nothing else.

(e) *Types of questions*

Many authors introduce the context distinction by distinguishing questions about discovery and questions about justification. Then they go on to illustrate these different types of questions with a few immediately intelligible examples. Other authors rely heavily on the difference between these types of

²¹ See the authors mentioned in the previous footnote; furthermore Braithwaite (1953), pp. 20–21.

²² See the authors mentioned for the distinctions under (b) and (c).

²³ See e.g. Popper (1972b), pp. 67–68; Salmon (1970), pp. 74–75, 80–81; Siegel (1980a), pp. 300–301; Siegel (1980b), p. 371.

questions when discussing the doubts raised about the distinction.²⁴ Usually no attention is paid to the fact that it is a distinction between *questions* that is introduced or is relied on. A representative of this attitude is Popper, who after having introduced the distinction between questions immediately turns to other distinctions that seem to be implied by the distinction between the questions:

The questions of justification or validity are of the following kind. Can a statement be justified? And if so, how? Is it testable? Is it logically dependent on certain other statements? Or does it perhaps contradict them? In order that a statement may be logically examined in this way, it must already have been presented to us. Someone must have formulated it, and submitted it to logical examination.

Accordingly I shall distinguish sharply between the process of conceiving a new idea, and the methods and results of examining it logically.²⁵

It may seem that questions simply provide a different form for any of the distinctions that have been given above under (a)–(d). But additionally, questions hint at an active element involved in the distinction to which I shall return in Section V.

(f)

In the literature there are further assimilations of the context distinction to other distinctions, for example to the distinction between “internal” and “external” history of science.²⁶ For our present purpose these assimilations may be neglected.

IV. The Criticism of the Distinction

A discussion of the attacks on the distinction must begin by determining their respective targets, since under the heading of an attack on the context distinction several different things may be covered. The common assertion that the distinction is invalid because “the contexts overlap” is therefore highly ambiguous. Sometimes an attack is directed against several different distinctions at once, i.e. the opponents also conflate some of the different

²⁴ See e.g. Amsterdamski (1975), pp. 51–52; Feigl (1964a), pp. 472–473; Feigl (1964b), p. 46; Feigl (1970b), p. 4; Feigl (1974), p. 2; McMullin (1970), p. 257; Popper (1934), chapter 1, section 2; Popper (1972b), p. 67; Salmon (1973), chapter 1, section 3; Siegel (1978), pp. 19–20, 22; Siegel (1980a), pp. 307–308; Siegel (1980b), pp. 370–371.

²⁵ Popper (1934), chapter 1, section 2. The passage also indicates Popper's conflation of distinctions (a), (b) and (e). The further conflation with distinctions (c) and (d) may be seen in the context of the passage just quoted. Nickles does not consider a distinction between questions in his analysis (1980b).

²⁶ See e.g. Feigl (1970b), p. 4; Feigl (1974), pp. 1–2; Heidelberger (1976), p. 323; and McMullin's reply to this assimilation in his (1974), p. 22.

distinctions. Only after identifying the object(s) of such an attack does a consideration of its credentials make sense.

(a) *Discovery and justification as temporally indistinct processes*

This kind of attack is directed against the distinction of discovery and justification as processes. It is a common criticism,²⁷ and it is usually argued for with the help of the history of science, specifically by presentation of examples of scientific episodes in which there is no clear-cut temporal distinction between a process of discovery and a process of justification.

But at least some defenders of the context distinction state themselves

that the processes of discovery and justification are intimately intertwined, with steps of one type alternating with steps of the other. There is no reason to conclude, from a distinction between the context of discovery and context of justification, that the entire process of discovery must be completed before the process of justification can begin.

There are even cases in which "the process of discovery and the process of justification may be nearly identical".²⁸

(b) *Discovery as having logical aspects*

This kind of attack is directed against the distinction which asserts that discoveries may be analysed only in terms of empirical sciences, such as psychology, etc. because they have no logical aspects (Section IIIc). This assumption came under attack beginning with Hanson.²⁹ The well-known problems of this attack consist in the precise articulation of what is meant by the "logical aspects of discoveries", and whether these aspects differ from the logical means of justification. At present this criticism is made in the form of the attack next considered.

(c) *Necessity of an at least threefold distinction*

This kind of attack originated from the discussion of Hanson's views mentioned above. Its starting point is that the discovery/justification distinction is ambiguous. This ambiguity can be made apparent by noting that the common usage of "discovery" includes some sort of justification.³⁰

²⁷ See e.g. Feyerabend (1970), pp. 70–71; Feyerabend (1975), chapter 14; Mowry (1985), p. 79; Nickles (1980b), pp. 13–14.

²⁸ Salmon (1970), pp. 71–72.

²⁹ For a discussion of the development of Hanson's view, for the main criticism, and for references see Nickles (1980), pp. 22–25; furthermore Hanson (1971b). See also recently Zahar (1983).

³⁰ See e.g. Curd (1980), pp. 201–202; Gutting (1980), p. 221; Kordig (1978), pp. 112–114; McLaughlin (1982b), pp. 70–71; Scott (1980), pp. 277–278, pp. 287–288.

Saying "someone has discovered that p " implies that he or she has acquired some knowledge about p , and this in turn requires some sort of justification. The discovery/justification distinction should therefore be replaced by a distinction that is at least threefold.³¹ Different writers disagree on precisely how the new distinctions should be drawn, but roughly, they can be described as follows. In the first phase a theoretical idea, a hypothesis, or a theory sketch is "generated". In the second phase the plausibility of the idea is assessed. It may be compared with alternative ideas, and/or it may be elaborated on. In other words, it is "pursued". Finally, the elaborated idea may be subjected to critical testing and, if it is successful, it may be "accepted". A fourfold distinction replacing the original twofold one has been proposed by Goldman.³² With respect to the problem-solving activity he distinguishes between generation, pursuit, test and decision.

In this form, the proposed threefold or fourfold distinctions are an attack on the discovery/justification distinction in the sense of two processes that take place one after another (Section IIIa). But the new distinctions are also considered to be methodological ones, although there is a fair amount of disagreement about the correct characterization of the methodological status of the different phases.³³ Unless both the "generation" and the "pursuit" phase can only be subjected to psychological and sociological analysis, the new distinctions also attack that form of the context distinction that distinguishes the logical from the empirical (Sections IIIc and d).

(d) *Justification as having sociological and psychological aspects*

This kind of attack is also directed against the context distinction conceived as distinguishing the logical from the empirical, its main proponent being Kuhn. This criticism is complementary to the one of discoveries not having logical aspects (Section IVb). It is maintained that in the actual decisions concerning theory choice there are factors that play a role which can only be described in sociological or psychological terms.³⁴ Sociological factors come into play since the decision of a scientific community with respect to theory choice can only be explained with recourse to the system of cognitive values held by this community. The particular system of cognitive values is, however,

³¹ See e.g. Blackwell (1980); Curd (1980); Kordig (1978), pp. 114–116; Laudan (1977), pp. 108–114; Laudan (1980), pp. 173–175; McLaughlin (1982b) and (1982c); Nickles (1980b), pp. 18–22; Schaffner (1980), pp. 178–200. Many of the motives for these new distinctions can already be found in Kuhn (1962b).

³² Goldman (1983), pp. 32–33.

³³ See references cited in the previous footnotes; furthermore Hattiangadi (1980).

³⁴ See mainly Kuhn (1977b); the reference to the distinction between the contexts is on pp. 326–327; see also Kuhn (1962a), pp. 8–9. For related versions of the attack see Amsterdamski (1975), pp. 52–66; Feyerabend (1975), chapter 14; Paller (1986); Suppe (1974), pp. 125–127; and remarkably early Fleck (1935), chapter 2, section 1.

not universal. It may vary slightly from one scientific community to another, and in addition, it may vary in time. Psychological factors come into play since the decision of a single member of this community can only be explained by the particular way this member interprets communal cognitive values. That such factors do indeed play a role is demonstrated, for instance, by the fact that even in a unanimous group decision individual decisions may be considerably spread out over time without being irrational.

Against this position, Siegel maintains it confuses a "context of decision" with the context of justification".³⁵ Siegel contends that it may well be that scientists make decisions that involve the sort of factors described above. Thus, it is important to be aware of these factors if one wants to understand actual scientific decision making. But it is another question whether the reasons used for actual theory choice are *good* ones, and this is the sort of question one asks in the context of justification.

But I believe that Kuhn's intentions are more radical than Siegel seems to realize. Kuhn really means justified decisions, justified in the sense that the choices made are in accord with values that actually constitute good reasons. One could argue that Kuhn's account is not sufficient since what he proposes as good reasons is individual and group dependent, and therefore also time dependent, and *good* reasons should be completely group and individual independent. But Kuhn would object by insisting that scientific reasons that are group and individual independent, and are furthermore sufficient to determine theory choice do not exist.³⁶ Moreover, if these kinds of reasons were the only legitimate scientific ones science would be reduced to a one person game with devastating consequences, as this would not allow for rational disagreement between scientists.

It is not the aim of this paper to judge whether Kuhn's theory about scientific reasons is right or wrong. All that is being asserted is that Kuhn's position does indeed contain an attack on the distinction between the contexts if identified with the distinction between the logical and the empirical.

(e) *Psychology and other empirical disciplines as being relevant to epistemology*

This kind of attack is directed against the context distinction understood as completely separating philosophy from the empirical disciplines (Section III d). This attack is strongly related to the previous attack, though its main thrust is somewhat different. I cannot possibly review this attack in its full scope here, as it includes the current controversies on the status of Piagetian "genetic

³⁵ Siegel (1980a), pp. 309–313 and almost identically, Siegel (1980b), pp. 369–372. A related criticism that fails for similar reasons can be found in Scheffler (1967), p. 89 and (1972), p. 368.

³⁶ Kuhn (1962a), pp. 3–5.

epistemology", of biological "evolutionary epistemology", and of Quinean "naturalized epistemology".³⁷ In each of these disciplines it is maintained that empirical knowledge is relevant to the task of epistemology, though the different defenders of these disciplines vary considerably with respect to the degree to which empirical knowledge must be incorporated into epistemology.

When epistemology seeks to justify the possibility of empirical knowledge, then any epistemological approach that is based upon the presupposition of valid empirical knowledge, results in circularity. This is conceded by some of those who intend to bring empirical knowledge into epistemology³⁸ (and the others should concede it). Thus the issue is not whether such circularity exists, but rather what the status of this circularity is. Is it a vicious circularity that completely invalidates any epistemological enterprise which makes use of empirical knowledge? Or is it an unavoidable circularity with which one has to learn to live? I cannot discuss all the arguments that have been given with regard to this question, but I will treat one that may serve to clarify the opposing positions.

It is an almost standard objection to the intrusion of psychology into epistemology that

a psychological claim can never be genuinely justificatory, can never be an epistemologically justificatory claim, because it can never by itself offer good reasons for taking some knowledge-claim to be true. ... (P)ychological information can never by itself give us good reasons for accepting some particular knowledge-claim to be true.³⁹

This argument has potential force only against those who contend that epistemology can be *completely reduced* to psychology or some other empirical discipline. Whether the argument is fully convincing with regard to that position may be left open in the present context. But to state that an empirical discipline may be *relevant* to epistemology is weaker than an assertion of reducibility. The argument given above does not apply in this case.

V. Consequences

The aim of this paper is not to resolve all or even some of the controversies just encountered; its aim is rather to understand the unsatisfactory course of the debate about the context distinction.

³⁷ Discussions of these topics with explicit recourse to the distinction between the contexts can be found in Haack (1975) and in Siegel (1978) and (1980a).

³⁸ See e.g. Quine (1969b), pp. 75 – 76; Haack (1975), pp. 169 – 171.

³⁹ Siegel (1980a), p. 315.

It is striking that none of the attacks on the context distinction has been directed against the distinction between the factual and the normative (Section IIIb). But this difference seems to be the core of the context distinction as intended by its proponents. All the other distinctions presented in Section III rest upon the distinction of the normative and the factual. Let us therefore look more closely at this distinction.

The difference between the factual and the normative as it is meant here, is not, at least not primarily, a difference in subject matter. Rather, it is a difference of perspective. A characteristic result of the perspective that is directed towards the factual, is an (accurate) description of what is the case. The subject matter of the description may be a historical event or process, an idea, an in some sense existing norm, or whatever. In the normative perspective, on the other hand, one is not content with a description, however accurate this description may be. Rather, an appraisal in certain respects is the issue. In our case, the normative perspective consists in an attempt to evaluate the extent to which cognitive claims are justified and the manner of their justification.

Two comments are in order here. First, the distinction just given does not imply that the factual has absolutely nothing to do with the normative. For instance, the facts that are addressed in the factual perspective may be norms themselves. Furthermore, to look at something in the factual perspective implies acceptance of certain norms, i.e. norms that guide accurate descriptions and the like. But following those norms is different from evaluating them. Second, in distinguishing the two perspectives we do not make any assumptions about *how* a normative evaluation should be carried out. We only assume *that* the normative perspective is possible, i.e. that it makes sense to look at processes or products of science from the perspective of their justification. But this possibility is given by the very nature of science, I believe. Science necessarily contains (knowledge) claims that can fail; in the normative perspective one asks whether they actually fail or not.

If this view is adopted, then the relevance of the above-mentioned distinction between types of questions (Section IIIe) may become clear. The fact that the context distinction is couched in terms of a distinction between questions, indicates that the distinction implies an active element on part of the questioner.⁴⁰ This active element consists in a choice between different perspectives in regard to matters involving claims. These claims may be either described, or evaluated.

It seems that the distinction between the factual and the normative as presented above was never the target of the attacks on the context distinction. Indeed, it would be very odd to assert that there is absolutely no difference

⁴⁰ Hintikka (1981), p. 81.

between the factual and the normative. To my best knowledge no opponent of the distinction has made such an odd assertion. The attacks are directed, rather, against what can be summarized as *particular theories about discovery and justification*. The targets include the theory that the processes of discovery and justification follow each other in strict temporal order, that discoveries are not subject to logical principles, that justification is a matter of formal logic alone, etc. This criticism does not imply, however, that there is no fundamental difference between the normative and the factual. The criticism of the context distinction may therefore also be expressed in the following way: its target is the conflation of the (valid) distinction between the normative and the factual with other distinctions; specifically with the (probably invalid) distinction between types of processes (Section IIIa), with the (possibly valid) distinction between the logical and the empirical (Section IIIc), and with the (possibly valid) distinction between philosophy and empirical disciplines (Section III d).

On the basis of this analysis, one can understand why the controversy about the distinction between the "context" of discovery and the "context" of justification has taken such an unsatisfactory course. Five sources of misunderstanding can be distinguished. First, up to four or five different distinctions are implicitly combined in the distinction between the so-called contexts as it is usually presented by its proponents. Second, the difference between some of these distinctions indeed disappears if certain concepts and theories about discovery and justification, and about the aims and legitimate methods of philosophy are presupposed. Third, the opponents of the distinction usually formulate their criticism as if it were directed against the context distinction as a whole. Fourth, these criticisms do not, in fact, address the distinction that is at the bottom of the context distinction, namely, the distinction between the normative and the factual. Finally, these criticisms address other distinctions combined in the context distinction and/or they address their conflation with the normative/factual distinction. These five sources of misunderstanding clearly provide ample opportunity for the proponents and the opponents of the so-called context distinction to talk at cross-purposes.

Acknowledgements — A first draft of this paper was written at Massachusetts Institute of Technology, Department of Linguistics and Philosophy, where I was a visiting scholar in 1984 – 1985. Critical comments by David Anderson, Sylvain Bromberger, Paul K. Feyerabend, Thomas S. Kuhn, Thomas Uebel and two anonymous referees on earlier drafts of this paper are gratefully acknowledged. I also wish to thank Russell Hilliard for his comments about the English.

Bibliography

Amsterdamski, S. (1975) *Between Experience and Metaphysics. Philosophical Problems of the Evolution of Science*. *Boston Studies in the Philosophy of Science* 35 (Dordrecht: Reidel).

- Blackwell, R. J. (1980) 'In Defense of the Context of Discovery', *Revue Internationale de Philosophie* 34, 90–108.
- Braithwaite, R.B. (1953) *Scientific Explanation. A Study of the Function of Theory, Probability and Law in Science* (Cambridge: Cambridge University Press), 3rd edn.
- Bunge, M. (1964) *The Critical Approach to Science and Philosophy* (New York: Free Press).
- Carnap, R. (1928) *Der logische Aufbau der Welt* (Berlin: Weltkreis). English translation: *The Logical Structure of the World* (Berkeley: University of California Press, 1969).
- Carnap, R., Hahn, H. and Neurath, O. (1929) *Wissenschaftliche Weltauffassung — Der Wiener Kreis* (Wien: Artur Wolf). English translation: 'The Scientific Conception of the World: the Vienna circle', in: O. Neurath *Empiricism and Sociology*, M. Neurath and R. S. Cohen (eds), (Dordrecht: Reidel, 1973), pp. 299–318.
- Chisholm, R. et al. (eds) (1964) *Philosophy* (Englewood Cliffs: Prentice Hall).
- Chmielecka, E. (1982) 'The context of discovery and justification: a reappraisal', in: Krajewski (1982), pp. 63–74.
- Cohen, H. (1883) *Das Prinzip der Infinitesimal-Methode und seine Geschichte. Ein Kapitel zur Grundlegung der Erkenntniskritik* (Berlin: Dümmler).
- Cohen, R. S. and Wartofsky, M. W. (eds) (1974) *Methodological and Historical Essays in the Natural and Social Sciences. Boston Studies in the Philosophy of Science 14* (Dordrecht: Reidel).
- Curd, M. V. (1980) 'The logic of discovery: an analysis of three approaches', in: Nickles (1980a), pp. 201–219.
- Feigl, H. (1964a) 'What is philosophy of science?', in: Chisholm et al. (1964), pp. 465–539.
- Feigl, H. (1964b) 'What Hume might have said to Kant (and a few questions about induction and meaning)', in: Bunge (1964), pp. 45–51.
- Feigl, H. (1970a) 'The "orthodox" view of theories: remarks in defense as well as critique', in: Radner/Winokur (1970), pp. 3–16.
- Feigl, H. (1970b) 'Beyond peaceful coexistence', in: Stuewer (1970), pp. 3–11.
- Feigl, H. (1974) 'Empiricism at bay? Revisions and a new defense', in: Cohen/Wartofsky (1974), pp. 1–20.
- Feyerabend, P. K. (1970) 'Against method: outline of an anarchistic theory of knowledge', in: Radner/Winokur (1970), pp. 17–130.
- Feyerabend, P. K. (1975) *Against Method. Outline of an Anarchistic Theory of Knowledge* (London: New Left Books).
- Fine, A. and Machamer, P. (eds) (1986) *PSA 1986. Proceedings of the 1986 Biennial Meeting of the Philosophy of Science Association, Vol. 1* (East Lansing: Philosophy of Science Association).
- Fleck, L. (1935) *Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Einführung in die Lehre vom Denkstil und Denkkollektiv* (Frankfurt: Suhrkamp). English translation: *Genesis and Development of a Scientific Fact* (Chicago: University of Chicago Press, 1979).
- Frege, G. (1879) *Begriffsschrift, eine der arithmetischen nachgebildete Formelsprache des reinen Denkens* (Halle: Louis Nebert). English translation in: van Heijenoort (1970), pp. 5–82.
- Frege, G. (1884) *Die Grundlagen der Arithmetik. Eine logisch-mathematische Untersuchung über den Begriff der Zahl* (Breslau: Koebner). English translation: *The Foundations of Arithmetic* (Oxford: Basil Blackwell, 1950).
- Goldman, A. I. (1983) 'Epistemology and the theory of problem solving', *Synthese* 55, 21–48.
- Gutting, G. (1980) 'The logic of invention', in: Nickles (1980a), pp. 221–234.
- Haack, S. (1975) 'The relevance of psychology to epistemology', *Metaphilosophy* 6, 161–176.
- Hanson, N. R. (1971a) *What I Do Not Believe and Other Essays* (Dordrecht: Reidel).
- Hanson, N. R. (1971b) 'The idea of a logic of discovery', in: Hanson (1971a), pp. 288–300.
- Hattiangadi, J. N. (1980) 'The vanishing context of discovery: Newton's discovery of gravity', in: Nickles (1980a), pp. 257–265.
- Heidelberger, M. (1976) 'Some intertheoretic relations between Ptolemean and Copernican astronomy', *Erkenntnis* 10, 323–336.
- Heijenoort, J. van (ed.) (1970) *Frege and Gödel. Two Fundamental Texts in Mathematical Logic* (Cambridge: Harvard University Press).
- Herschel, J. F. W. (1830/1831) *A Preliminary Discourse on the Study of Natural Philosophy* (London: Longman).
- Hintikka, J. (1981) 'On the logic of an interrogative model of scientific inquiry', *Synthese* 47, 69–83.

- Husserl, E. (1913) *Logische Untersuchungen* (2nd. edn; 5th. edn) (Tübingen: Niemeyer). English translation: *Logical Investigations* (New York: Humanities Press, 1970).
- Kant, I. (1781/1787) *Kritik der reinen Vernunft* (Hamburg: Meiner, 1956). English translation: *Critique of Pure Reason* (New York: McMillan, 1929).
- Kant, I. (1783) *Prolegomena zu einer jeden künftigen Metaphysik, die als Wissenschaft wird auftreten können* (Meiner: Hamburg, 1957).
- Kordig, C. R. (1978) 'Discovery and justification', *Philosophy of Science* 45, 110 – 117.
- Krajewski, W. (ed.) (1982) *Polish Essays in Philosophy of the Natural Sciences* (Dordrecht: Reidel).
- Kuhn, T. S. (1962a) *The Structure of Scientific Revolutions* (2nd edn) (Chicago: University of Chicago Press, 1970).
- Kuhn, T. S. (1962b) 'The historical structure of scientific discovery', reprinted in: Kuhn (1977a), pp. 165 – 177.
- Kuhn, T. S. (1977a) *The Essential Tension. Selected Studies in Scientific Tradition and Change* (Chicago: University of Chicago Press).
- Kuhn, T. S. (1977b) 'Objectivity, value judgement, and theory choice', in: Kuhn (1977a), pp. 320 – 339.
- Laudan, L. (1977) *Progress and its Problems. Towards a Theory of Scientific Growth* (Berkeley: University of California Press).
- Laudan, L. (1980) 'Why was the logic of discovery abandoned?', in: Nickles (1980a), pp. 173 – 183.
- Losee, J. (1972) *A Historical Introduction to the Philosophy of Science* (Oxford: Oxford University Press).
- McLaughlin, R. (ed.) (1982a) *What? Where? When? Why? Essays on Induction, Space and Time, Explanation* (Dordrecht: Reidel).
- McLaughlin, R. (1982b) 'Invention and appraisal', in: McLaughlin (1982a), pp. 69 – 100.
- McLaughlin, R., (1982c) 'Invention and induction: Laudan, Simon and the logic of discovery', *Philosophy of Science* 49, 198 – 211.
- McMullin, E. (1970) 'Discussion', in: Radner/Winokur (1970), pp. 257 – 258.
- McMullin, E. (1974) 'Empiricism at sea', in: Cohen/Wartofsky (1974), pp. 21 – 32.
- Mowry, B. (1985) 'From Galen's theory to William Harvey's theory: a case study in the rationality of scientific theory change', *Studies in History and Philosophy of Science* 16, 49 – 82.
- Nickles, T. (ed.) (1980a) *Scientific Discovery, Logic, and Rationality. Boston Studies in the Philosophy of Science* 56 (Dordrecht: Reidel).
- Nickles, T. (1980b) 'Introductory essay: scientific discovery and the future of philosophy of science', in: Nickles (1980a), pp. 1 – 59.
- Nickles, T. (ed.) (1980c) *Scientific Discovery: Case Studies. Boston Studies in the Philosophy of Science* 60 (Dordrecht: Reidel).
- Paller, B. T. (1986) 'Naturalized philosophy of science, history of science, and the internal/external debate', in: Fine/Machamer (1986), pp. 258 – 268.
- Popper, K. R. (1934) *Logik der Forschung* (Tübingen: Mohr) 5th edn. English translation: *The Logic of Scientific Discovery* (New York: Basic Books).
- Popper, K. R. (1935) "'Induktionslogik" und "Hypothesenwahrscheinlichkeit"', *Erkenntnis* 5, 170 – 172.
- Popper, K. R. (1972a) *Objective Knowledge. An Evolutionary Approach* (Oxford: Clarendon Press).
- Popper, K. R. (1972b) 'Two faces of common sense', in: Popper (1972a), pp. 32 – 105.
- Quine, W. V. (1969a) *Ontological Relativity and Other Essays* (New York: Columbia University Press).
- Quine, W. V. (1969b) Epistemology naturalized, in: Quine (1969a), pp. 69 – 90.
- Radner, M. and Winokur, S. (eds) (1970) *Analyses of Theories and Methods of Physics and Psychology. Minnesota Studies in the Philosophy of Science* 4 (Minneapolis: University of Minnesota Press).
- Reichenbach, H. (1935) 'Zur Induktionsmaschine', *Erkenntnis* 5, 172 – 173.
- Reichenbach, H. (1938) *Experience and Prediction. An Analysis of the Foundations and the Structure of Knowledge* (Chicago: University of Chicago Press).
- Salmon, W. C. (1970) 'Bayes's theorem and the history of science', in: Stuewer (1970), pp. 68 – 86.
- Salmon, W. C. (1973) *Logic* (Englewood Cliffs: Prentice Hall).

- Schaffner, K. F. (1980) 'Discovery in the biomedical sciences: Logic or irrational intuition?', in: Nickles (1980c) pp. 171 – 205.
- Scheffler, I. (1967) *Science and Subjectivity* (Indianapolis: Hackett, 1982).
- Scheffler, I. (1972) 'Vision and revolution: a postscript on Kuhn', *Philosophy of Science* 39, 366 – 374.
- Schlick, M. (1918) *Allgemeine Erkenntnislehre* (Berlin: Julius Springer, 1925).
- Scott, W. T. (1980) 'The personal character of the discovery of mechanisms in cloud physics, in: Nickles (1980c), pp. 273 – 289.
- Siegel, H. (1978) 'Piaget's conception of epistemology', *Educational Theory* 28, 16 – 22.
- Siegel, H. (1980a) 'Justification, discovery and the naturalizing of epistemology', *Philosophy of Science* 47, 297 – 321.
- Siegel, H. (1980b) 'Objectivity, rationality, incommensurability, and more', *British Journal for the Philosophy of Science* 31, 359 – 384.
- Stuewer, R. H. (ed.) (1970) *Historical and Philosophical Perspectives of Science. Minnesota Studies in the Philosophy of Science* 5 (Minneapolis: University of Minnesota Press).
- Suppe, F. (1974) 'The search for philosophic understanding of scientific theories', in: Suppe (1977), pp. 1 – 241.
- Suppe, F. (1977) *The Structure of Scientific Theories* (Urbana: University of Illinois Press, 1974, 1977).
- Whewell, W. (1847) *The Philosophy of the Inductive Sciences, Founded Upon Their History* (London: Parker), 2nd edn.
- Zahar, E. (1983) 'Logic of discovery or psychology of invention?', *British Journal for the Philosophy of Science* 34, 243 – 261.