

A Historical Shift in Philosophy of Science

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Abstract: Following a history of empiricism from the Vienna Circle to Quine, in this paper I will show that a remarkable turn, which led empiricism to pragmatism, is witnessed. The Vienna Circle was faced with the crisis of skepticism, and in order to find an intersubjective ground for empirical knowledge, some logical positivists appealed to protocol sentences. However, there was not a consensus among the Vienna Circle's figures about the role and status of these sentences; protocol sentences were supposed, at least to some accounts, to fill the gap between empirical theories and the physical real world. It will show such attempts were not successful. Having argued against fundamental aspects of the Vienna Circle, Quine admitted that we cannot find epistemologically objective platform to build an empirical theory which represents the reality, rather we need to appeal to pragmatical criteria to circumvent skeptical concerns.

Keywords: The Vienna Circle, empiricism, protocol sentences, Quine, pragmatisms

Introduction

The primary task undertaken by the Vienna Circle was the philosophical understanding of scientific knowledge. The members of this influential group confronted with this skeptical obstacle which would challenge the objectivity and justification of empirical knowledge. The skepticism has philosophical doubt about the reliability of evidence based on our senses; from this point of view every empirical truth is doubtful because our sensory faculties likely mislead us. The skepticism worries about empirical knowledge that how we can justify knowledge objectively, and what kinds of justifications are appropriate for true beliefs to be called knowledge.

Generally, two classical answers have been provided for these skeptical concerns. We can take foundationalist or anti-foundationalist approaches to deal with the skepticism, and both views had their own proponents in the Vienna Circle. Foundationalists hold that all empirical knowledge consists of either fundamental or non-fundamental beliefs in a way that non-fundamental beliefs are grounded in fundamental ones which are self-justified. In contrast, anti-foundationalists reject the notion of self-justified beliefs, and some of them defend an alternative theory of justifications which is called coherentism. According to this view, epistemic justification is reached for a belief

if the belief is a member of a coherent set. What distinguishes coherentism from other theories of justification is that this coherent set is the primary bearer of justification.

The Vienna Circle, roughly speaking, saw its task in the historical situation. In order to bridge the gap between philosophy and empirical science, Kant appealed to the notion of *synthetic a priori* which provided an objectively intelligible picture of both the phenomena of contingent experience and the necessities of nature. All objective knowledge was achieved in terms of our continuing confrontation with ‘noumena’ or ‘things-in-themselves’.

According to Kant’s idea, science provides objective empirical knowledge, and philosophy tackles with the task of preparing the conditions of possibility and intelligibility of objective knowledge. However, such a Kantian answer did not sound satisfactory for the positivists due to the fact that in the new physical scientific theories, namely Einstein’s relativity theories, the notions of space and time are not compatible with Kantian *a priori* method. In addition, the emergence of non-Euclidean geometry posed a great difficulty in intelligibility of the notion of *synthetic a priori*.

One way to avoid from the problems in the Kantian account of grounding science, was a kind of radical empiricism which denies all *a priori* knowledge, but the mathematical knowledge was still problematic for this version of empiricism, especially when anti-psychologism critique of Frege -which prevents empiricism to provide a tenable account for the knowledge of arithmetic- is taken into account. Given these problems, the Vienna Circle tried to establish a plausible foundation for empirical sciences which would not face the foregoing difficulties. At the first step the Vienna Circle defended this idea that it is not incumbent upon empirical evidence to explain formal aspect of knowledge. All the factual and synthetic knowledge comes from experiences through *a posteriori* inquiries, and the formal part which is able to be justified *a priori* contains only tautologous truths. The advent of mathematical logic in the early twentieth century, namely, the project of *Logicism* paved the way for the Vienna Circle to assert that all necessary truths, i.e. mathematical and logical truths, are devoid of empirical contents, and they are testable *a priori*. Second, in order to draw a clear and distinct demarcation line between science and pseudo-science, particularly metaphysics, the Vienna Circle adopted verificationism as its theory of meaning. Based on this theory, a meaningful statement is the one that could be tested empirically in some sense. In this way, metaphysical concepts like causation, which are not empirically discernable,

were banned from science. So for the Vienna Circle all meaningful sentences are either synthetic, which are acquired *a posteriori* and are testable empirically, or analytic, which are tautologous.

Another aim of the Vienna Circle was the project of reductionism which is firmly tied with verificationism. The Circle's own methodologically monist position was sometimes represented under the heading of 'unified science'. (Uebel, 2014)

The Vienna Circle's epistemological attempts: The role of protocol sentences

Logical positivists confronted the skeptical problem, and it was their aim to find an objective ground for scientific sentences. Most members of this circle admitted that all knowledge is obtained based on logical inference from what they called 'protocol sentences' grounded in observable facts or sense data. These logical positivists would believe that expressions referring to existing things or to states of affairs are definable in terms of directly observable objects, or sense-data, and, hence, that any statement of fact is equivalent to some set of empirically verifiable statements. In particular, they held that the theoretical entities of science are definable in terms of observable physical things, so that scientific theories are equivalent to combinations of observation reports. Proponents of the unity of science believed that theoretical entities of particular sciences, such as biology or psychology, are definable in terms of those of some more basic science, such as physics; or that the laws of these sciences can be explained by those of the more basic science such as physics; or that the laws of these sciences can be explained by those of the more basic science (Hashemi, 2022, p. 958). This project implies the unity of science insofar as the definability of the theoretical entities of the various sciences in terms of the observable would constitute the common basis of all scientific theories.

Therefore, protocol sentences are the most elementary sentences about empirical facts. They are the final points of analysis of complicated scientific sentences, and are the foundations out of which complicated objective scientific theories about the natural world were supposed to be constructed. So they were epistemologically very important because the process of verification and empirical investigation terminated in such protocol sentences. However, protocol sentences would play a significant role for this aim of logical positivists, there was not a prevailing consensus among the influential positivist figures over what count as protocol sentences. Owing to the aim of this paper, we briefly review the views of Carnap in *Aufbau*, Neurath and Schlick about protocol

sentences; and the ways of justification of scientific theories according to these positivists are discussed.

Carnap's view

In *Aufbau* Carnap¹ tried to build an ideal language for the unified science. He provided an epistemological standpoint in which all concepts are derived from primitive experience by means of relational logic, and made a relation between the constructed language and the world by refereeing to primitive experiences. Carnap held that science is a system of statements built upon 'primitive protocol sentences', which describe the experiences of scientific observers. They describe only what is directly given, so need no further justification. (Carnap, 1928, p 89)

For Carnap, in order to show that a sentence is verifiable, we need to show that it stands in the proper logical relation to statements expressing first person knowledge. In short, Carnap's *Aufbau* project was to build a logico-mathematical structural system which is rooted in experience. If we translate scientific knowledge theories to this system, we can justify them. In the base of the system there are protocol sentences which are given immediately through experience, and they are unverifiable.

Neurath's view

Carnap's foundationalist project regarding protocol sentences cannot provide a satisfactory explanation for the cases that $\{P\}_{SEP}$ protocol $\{P\}_{SEP}$ sentences $\{P\}_{SEP}$ are contradictory. In addition, the *Aufbau* project was phenomenological or psychological because the immediate experiences are private and subjective, thus based on them we cannot construct intersubjective theories which represent the reality. In order to avoid these problems, Neurath put forward an anti-foundationalist theory, opposed to Carnap's foundationalist project.

¹ Carnap did not have the fixed idea about protocol sentences; however, he remained foundationalist about them. Here we only consider his view in *Aufbau*. Later in '*Psychology in Physical Language*' (1931) he tried to translate protocol sentences from psychology into the 'physical language'. The physical language is 'public' and 'inter-subjective', whereas the psychological language seems to be 'private' or 'subjective'. Due to the problems he confronted, in *LSL* (*Logical Structure of Language*) he admitted a completely formal language and in this language what a protocol sentence describes is not factual but syntactical and formal.

Schlick's view

Schlick's epistemological view was opposed to Neurath's thought, and had more similarity to Carnap's foundationalism. He rejected Neurath's coherence theory, and argued that even if one were to have a multitude of sentences that cohere with one another, one would face several of coherent sets, and this issue leaves him with the dilemma of deciding which of these coherent sets represents the reality or which of them is true. The situation becomes more critical when some of these coherent sets might be contradictory to each other.

Such a problem and the wide gap between the coherence theory and the reality led Schlick to assert that a foundation of knowledge is indispensable for empiricism so that it could be justified. Schlick imposed 'observation sentences' as the foundations. Observation sentences are confirmed via the immediate experiences. Thus the observation sentences are self-verifying, privileged and indubitable, and these sentences are what tie scientific theories to the reality. Schlick's defense of the correspondence conception of truth, explicated by his analysis of affirmations, committed him to the recognition of 'the one, true reality' and 'the real world'. (Oberdan, 2013)

Observation sentences are different from protocol sentences. These foundations do not possess a time. Once an experience is only accessible via memory, the certainty of the experience begins to diminish. Their form is 'here', 'now', so and so, such as 'here two black points coincide', or 'here now pain'. An observation sentence cannot be false because there is no difference between understanding it and verifying it, and they cannot be written down. Observation statements are certain first-person sentences. They are neither hypotheses nor the starting points of science, but are the means by which scientific hypotheses are confirmed. They are the end point of verification process, and in the moment of their occurrence they fulfill their duty. (Ibid) But the main problem that this foundationalist justification has is that it cannot escape from solipsism because, as it was mentioned, the immediate certain first person experiences are private and subjective. And there is no guarantee that based on them theories are connected or corresponded to the physical reality.

It has been mentioned that the Vienna Circle tried to save empiricism from skeptical challenges which would threaten objectivity and justification of scientific knowledge. Appealing to the linguistic apparatus, they first drew a clear-cut distinction between analytic and synthetic sentences in a way that the latter are verifiable empirically and the former are just conventional or logical or tautologous truths. And in order to construct the unified empirical science, they developed a reductionist approach towards the construction of scientific theories, so meaningful

statements are equivalent to some logical construct upon terms which refer to immediate experiences which are called protocol sentences or observation sentences as were described briefly.

It has been shown that all the attempts of Carnap, Neurath and Schlick for justifying scientific theories based on protocol or observation sentences faced serious problems preventing them to establish a reliable base for objectivity of scientific theories. They were unsuccessful to build the construction of intersubjective empirical science based on the immediate experiences. Carnap's *Aufbau* and Schlick's project both are in charge of falling into solipsism, and Neurath's view about protocol sentences, however, has advantages, but it is hard to show that how a coherent set of protocol sentences has priority over its rival coherent sets without appealing to pragmatical criteria. So it seems that logical positivists could not defeat skepticism. The issue becomes more serious when Quine's attacks against the fundamental pillars of the Vienna Circle are taken into account.

Quine's objections to the Vienna Circle's model of empiricism

Quine in his influential paper, *Two Dogmas of Empiricism*, holds there is no sharp distinction between claims that are true in virtue of their meaning (analytic claims), and empirical claims (claims that may be verified by facts). Quine argues that any attempt to define or explicate analyticity is circular, and no satisfactory explanation of analyticity has been given. When we want to explain what analyticity is, we already presuppose this vague notion. This is not the limitation of the natural language, even in purely formal and syntactical languages there is not any satisfactory explanation for this notion. Quine properly shows that the artificial "model which takes analyticity merely as in irreducible character is unlikely to throw light on the problem of explicating analyticity."(Quine, 1951, p36)

"That there is such a distinction [between analytic and synthetic sentences] to be drawn at all is an unempirical dogma of empiricists, a metaphysical article of faith."(Ibid, p 37)

Quine also argues that the second aspect of the Vienna Circle, i.e. reducing all meaningful statements of a scientific theory to imperial experiences, is another 'unempirical dogma'. If the verification theory can be accepted as an adequate account of statement synonymy, the notion of analyticity is saved after all.

The Vienna Circle's response to this question that how sentences are verified is that the verification is done via reductionism; the belief that each meaningful statement is equivalent to some logical construct upon terms which refer to immediate experience. Such reductionism, says Quine, presents just as intractable a problem as did analyticity.

Quine first observes that Carnap's starting point was not the strictest possible, as his 'sense-datum language' included not only sense-events but also "the notations of logic, up through higher set theory... Empiricists there are who would boggle at such prodigality." (Ibid, p 39) Nonetheless, says Quine, Carnap showed great ingenuity in defining sensory concepts "which, but for his constructions, one would not have dreamed were definable on so slender a basis." However, even such admirable efforts left Carnap, by his own admission, far short of completing the whole project. (Ibid, p 39)

Finally, Quine objects to Carnap's proposed translation of statements like 'quality q is at point-instant x;y;z;t' into his sense-datum language, because he does not define the connective 'is at'. Without statements of this kind, it is difficult to see, even in principle, how Carnap's project could have been completed. (Ibid, p 40) The difficulty that Carnap encountered shows that reductionism is, at best, unproven and very difficult to prove. Until a reductionist can produce an acceptable proof, Quine maintains that reductionism is another "metaphysical article of faith".

It might be said that Neurath project is immune from this attack due to the fact that his project was anti-foundationalist, and he hold that protocol sentences are corrigible and not indubitable, and set of protocol sentences, not only an empirical sentence, are verified. But it is worth mentioning that Quine's argument against reductionism is firmly tied with his view that there is no plausible distinction between analytic and synthetic truths. Neurath, like his positivist fellows, would put emphasis on such a distinction. In Neurath coherent theory only synthetic empirical protocol sentences which involved in a coherent theory are verifiable and corrigible, while in the Quine holistic view all aspects of a scientific theory even its mathematical or logical dimensions are corrigible and revisable.

"The totality of our so-called knowledge or beliefs, from the most casual matters of geography and history to the profoundest laws of atomic physics or even of pure mathematics and logic, is a man-made fabric which impinges on experience only along the edges. Or, to change the figure, total science is like a field of force whose boundary

conditions are experience. A conflict with experience at the periphery occasions readjustments in the interior of the field. Truth values have to be redistributed over some of our statements. Reevaluation of some statements entails reevaluation of others, because of their logical interconnections - the logical laws being in turn simply certain further statements of the system, certain further elements of the field. Having reevaluated one statement we must reevaluate some others, whether they be statements logically connected with the first or whether they be the statements of logical connections themselves. But the total field is so undetermined by its boundary conditions, experience, that there is much latitude of choice as to what statements to reevaluate in the light of any single contrary experience. No particular experiences are linked with any particular statements in the interior of the field, except indirectly through considerations of equilibrium affecting the field as a whole. [...] Even a statement very close to the periphery can be held true in the face of recalcitrant experience by pleading hallucination or by amending certain statements of the kind called logical laws. Conversely, by the same token, no statement is immune to revision. Revision even of the logical law of the excluded middle has been proposed as a means of simplifying quantum mechanics.” (Ibid, pp.42-43)

Quine proposes that, instead of reductionism, it is the whole field of science and not single statements that are verified. All scientific statements are interconnected. Logical laws give the relation between different statements, while they also are statements of the system. No statement is immune from revision. Even logical laws can be revised. Quine, opposed to the Vienna Circle, rejects the clear-cut demarcation between natural science and metaphysics, and puts his step further that epistemologically physical objects are on a par with gods of Homer.

However, like Gods of Homer, physical objects are posits, and there is no great epistemic difference in kind; the difference is rather that the theory of physical objects has turned out to be a more efficient theory. For Quine the function of science is to predict future experiences in the light of past ones, the only grounds for choosing which explanations to believe are pragmatical criteria such as simplicity, precision, explanatory power, parsimony, and so on. The change in the system of science is not for the reason that the system does not truly represent the reality, but rather pragmatical dimensions require any revision or change in the system.

These remarks indicate that empiricism's attempts to reach entirely pure objective empirical knowledge which represents the natural world and is devoid of metaphysical assumptions have been abortive. Indeed, Quine shows that such a thing is not achievable, and through pure empirical criteria we cannot attain objective scientific knowledge (Hashemi, 2017, p. 37). Consequently, it means that serious skeptical worries regarding such knowledge have not been dismissed in spite of the Vienna Circle's efforts. Quine also refutes the objectivity of meaning and even physical objects as stable entities which are labeled by languages in a way that although we can change labels (languages), the meaning or objects will be unaffected by any change of labels. Quine objects to this 'museum theory' of language.

“Uncritical semantics is the myth of a museum in which the exhibits are meanings and the words are labels. To switch languages is to change the labels” (Quine 1969: 27)

He argues that our understanding of language can only come from the observation of behavioral evidence, which is the only evidence we have, but these evidences are indeterminate. Such indeterminacy shows itself properly in translation between languages that is the presentation of a synonym between terms or sentences of the different languages, for example, 'Hello' in English and 'Salam' in Farsi. Indeed, Quine holds that there are no determinate meanings of these terms or sentences² that show these two terms are different labels of that meaning. According to Quine, we are exclusively confined to sensory stimuli, that based on them we cannot epistemologically conclude that different linguistic responses can be discovered to be exactly the same in meaning or reference. The observation and comprehension of behavioral evidence is dependent on experience, so different individuals will form their own translation manuals. How do we decide which translation manuals are correct? We would decide that which translation were correct when we had such objective behavioral evidence. As there is no such thing, translation is subjective and thus indeterminate. So meaning is subjective and indeterminate.

Quine applies similar arguments to show that such indeterminacy also exist in the case of reference. (Ibid, pp. 46-47) Inscrutability of reference indicates that there is never just one possibility to which object a certain word or sentence of a language refers. Quine's idea about

² This view also provides another argument against the distinction between analytic and synthetic statements. As there is no determinate meaning, there is no good explanation of synonymy.

inscrutability of Reference is firmly tied with his view about indeterminacy of translation. We are told that, if we try to determine what the referential object of a certain word is, our answer will always be relative to our own background language. For Quine, acquisition of language from sensory stimuli is an appropriate case study for knowing how scientific theories are shaped. So the idea of indeterminacy is not only limited to language, but is applied also for scientific theories. Therefore, there is no terminal point that shows which scientific theory represents real entities, theories have their own ontological commitments, and we can never epistemologically determine which one is real. We only choose the one which satisfies the mentioned pragmatical criteria.

Considerable Turn from Empiricism to Pragmatism

It seems to me that a turn regarding the initial goal of empiricism is witnessed: a turn from empiricism to pragmatism. Quine explicitly admits that there is no entity beyond theories. Every theory is committed to the entities which are imposed by it. Epistemologically all of them are on a par, and only pragmatically we can decide which one is more useful. Such historical overview shows that this significant assumption of empiricism that we can acquire true objective knowledge based on the experience we have of the world through sensory entrances is faded or vanished in Quine's philosophy.

Quine holds that if we are really committed to empiricism we need to appeal to pragmatical criteria not empirical ones to see which theory is more appropriate, we cannot understand that which one represents the reality, and even such an assumption that there is an external world is beyond our sensory evidence to be justified. Protocol sentences were supposed to bridge this gap between the empirical theories and the reality, but different accounts of them confronted serious difficulties. It seems to me that in Quine's philosophy empiricism is explicitly separated from realism- the view that there is a mind-independent world to which the theories refer, and consequently it approaches to epistemological relativism. Therefore, epistemologically we cannot face the mentioned skeptical concerns. The concerns remain, and Quine admits that not epistemologically but rather pragmatically we have to deal with them. Here there is a turn from empiricism to pragmatism.

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