THE HERITAGE OF THE VIENNA CIRCLE: THE REVIVAL OF EMPIRICISM THROUGH THE ASSIMILATION OF METAPHYSICS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

YEVGENIYA KULANDINA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
THE DEPARTMENT OF PHILOSOPHY

AUGUST 2019

Approval of the Graduate School of Social Sciences

_____

Assoc. Prof. Dr. Sadettin Kirazci
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

_____

Prof. Dr. Ş. Halil Turan
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy.

_____

Assoc. Prof. Dr. Samet Bağçe
Supervisor

Examining Committee Members

Asst. Prof. Dr. Sandy Berkovski	(Bilkent, PHIL)	_____
Assoc. Prof. Dr. Samet Bağçe	(METU, PHIL)	_____
Prof. Dr. Ayhan Sol	(METU, PHIL)	_____
Asst. Prof. Dr. Rafael Ventura	(Bilkent, PHIL)	_____
Assoc. Prof. Dr. Emre Arda Erdenk	(KMU, PHIL)	_____

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : Yevgeniya Kulandina

Signature :

ABSTRACT

THE HERITAGE OF THE VIENNA CIRCLE:
THE REVIVAL OF EMPIRICISM THROUGH
THE ASSIMILATION OF METAPHYSICS

Kulandina, Yevgeniya

Ph.D., Department of Philosophy

Supervisor: Assoc. Prof. Dr. Samet Bağçe

August 2019, 153 pages

This thesis aims to examine whether one can establish an evaluative account that can be efficiently applicable to the actual scientific practice. In this regard, the heritage of the Vienna Circle, particularly its 'radical' elaboration of empiricism implemented through the rejection of metaphysics, is taken as the starting point of analysis. Setting aside the limitations of the standard interpretation of the Vienna Circle, the heuristic aspects of Otto Neurath's non-foundationalism are examined and further assessed through Willard van Orman Quine's naturalism. It is inferred from this analysis that the tension between Neurath's non-foundationalism and his anti-metaphysical attitude remains as a restriction to the basic aim of this thesis. Thus, it is conjectured that certain metaphysical assumptions are indispensable for an adequate empiricist account of scientific activity. In this respect, it is put forward that a reconceptualization of the verifiability together with Neurath's account of

protocol statements can allow to establish an effective non-foundationalist account, not ignorant to the heuristic value of metaphysics in science.

Keywords: Vienna Circle, Neurath, non-foundationalism, metaphysics.

ÖZ

VİYANA ÇEVRESİ'NİN MİRASI:
METAFİZİĞİN ÖZÜMLENMESİYLE
DENEYCİLİĞİN YENİDEN CANLANMASI

Kulandina, Yevgeniya
Doktora, Felsefe Bölümü
Tez Yöneticisi: Doç. Dr. Samet Bağçe

Ağustos 2019, 153 sayfa

Bu tez, verimli bir şekilde fiilen bilimsel pratiğe uygulanabilir değerlendirmeci bir hesabın tesis edilebilirliğini incelemeyi amaçlamaktadır. Bu bakımdan metafiziğin reddi aracılığıyla deneyciliğe uygulanan 'radikal' düzenlemesi özelinde Viyana Çevresi'nin mirası, analizin başlangıç noktası olarak alınmaktadır. Viyana Çevresi'nin standart yorumunun kısıtlarını bir kenara bırakılarak, Otto Neurath'ın temelciliğe karşı olan görüşünün höristik yönleri incelenmekte ve Willard van Orman Quine'ın natüralist görüşü üzerinden bir değerlendirmesi sunulmaktadır. Bu analizden çıkarıldığı üzere Neurath'ın temelciliğe ve metafiziğe karşı olan tutumları arasındaki gerilim, bu tezin temel amacına getirilebilecek bir kısıtlama olarak durmaktadır. Bu nedenle, belirli metafiziksel varsayımların bilimsel aktivitenin deneyci hesabının uygun bir şekilde verilmesi için kaçınılmaz olduğu yorumunda bulunulmaktadır. Bu bağlamda, Neurath'ın protokol ifadeler hakkındaki görüşü ile beraber doğrulanabilirliğin yeniden kavramsallaştırılmasının, bilimdeki metafiziğin

höristik değerini yok saymadan, etkili bir temelcilik karşıtı hesabın tesis edilmesine imkân sağlayacağı öne sürülmektedir.

Anahtar Kelimeler: Viyana Çevresi, Neurath, temelcilik karşıtı, metafizik.

To All Curious Minds

ACKNOWLEDGMENTS

The author wishes to express her deepest gratitude to her supervisor, Assoc. Prof. Dr. Samet Bağçe, for his kindness, patience, countless inspiring discussions and his competency in academic guidance throughout the research.

The author would also like to thank the examining committee members, Prof. Dr. Ayhan Sol, Assist. Prof. Dr. Rafael Ventura, Assoc. Prof. Dr. Emre A. Erdenk, and especially Assist. Prof. Dr. Sandy Berkovski, for their objective criticism, advice, insightful suggestions and comments, which helped to improve on the structure and content of the thesis.

The last but not least, the author is grateful to the family and friends, whose endless support and motivation encouraged not to give up and accomplish this difficult task successfully.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

The Vienna Circle (*Der Weiner Kreis*) can be regarded as one of the most remarkable movements in philosophy of the twentieth century. The reason for such an evaluation lies not only in the achievements of its high-profile members[1], but also in its 'radical', so to speak, attitude towards 'old-school' philosophy[2], or, in the Circle's terminology, any kind of "meaningless" talk. By appealing to the developments in logicism, presented in *Principia Mathematica* (1910–1913) by Alfred Whitehead and Bertrand Russell, which were further advanced in the field of language by Ludwig Wittgenstein in his *Tractatus Logico-Philosophicus* (1922), the Vienna Circle pronounced a historical elaboration of classical empiricism[3] that resulted in the 'innovative', strictly scientific approach. However, as history shows, such an elaboration did not turn out to be much influential among its successors – the efforts of the Circle were lost in vain and nowadays the approach appears much out of date. One possible explanation for such a neglect is that the approach of the

[1] Such influential figures as Rudolf Carnap, Philipp Frank, Moritz Schlick, Hans Hahn and Otto Neurath were all members of the Circle.

[2] The phrase 'old-school philosophy' is a general formulation of the Vienna Circle's attitude towards metaphysics, or presupposition that a certain set of principles and assumptions, which are conceivable independently of experience, should be treated as the *ultimate* foundations of knowledge. For instance, for Carnap metaphysics was

> …the field of alleged knowledge of the essence of things which transcends the realm of empirically founded, inductive science. Metaphysics in this sense includes systems like those of Fichte, Schelling, Hegel, Bergson, Heidegger [Carnap, 1959: 80].

Neurath also referred to the 'old-school philosophy' as the "traditional school philosophy" [Neurath, 1930/1983: 47], "school philosophy" or "old-fashioned philosophising" [Neurath, 1931a/1983: 49].

[3] For instance, the empiricism of David Hume or John S. Mill.

Vienna Circle was evaluated in a certain manner, or in a way of the "standard" interpretation[4]. Fortunately, more recent evaluations of the Vienna Circle[5] allow for a more comprehensive view on the subject, or for rediscovery of the promising, fruitful aspects of the Circle's philosophical accomplishments. In turn, these aspects can provide the grounds to shed some light on the recent issues in the methodology and philosophy of science. In particular, it is proposed that such a re-evaluation of the Vienna Circle will help to answer certain questions, the most critical of which can be presented as follows. Can one establish a general method of evaluation for the scientific activity? If there is such a possibility, should it be purely normative in order to guarantee a *rational* scientific inquiry? If not normative, what is (are) the heuristic(s) of such method? More generally, how can a contemporary philosopher of science define his/her evaluative inventory, which will allow to maintain the reliability of scientific activity as sensitively as possible, when at the same time the process of theory-change in science is undeniable?

Here, choosing the Vienna Circle as the centre of examination in seeking possible answers to these questions is not accidental. As will be demonstrated below, one of the most striking arguments of the Vienna Circle is its attack against metaphysics. This attack is supported by the Circle's principle of verifiability – the thesis that only meaningful propositions, or propositions that are in principle verifiable by experience, should be maintained within the scope of scientific enterprise. Thus, the questions addressed a few lines above can be complemented as follows. Is the Vienna Circle's attack on metaphysics, based on the correlation of meaning and verifiability, efficient enough, so one can comprehend scientific inquiry without any reference to metaphysics? If there is no possibility to avoid metaphysical

[4] In general terms, by the 'standard interpretation of the Vienna Circle' here one should consider representing the Vienna Circle as the group of philosophers who unanimously advocated for logical positivism, or philosophical view that urged for the refinement of all 'meaningless' components from the "scientific conception of the world" through the logical analysis of language. The limitations of this interpretation will be discussed in more detail in chapter 2.

[5] Namely, the works of Thomas Uebel (2008, 2014), Friedrich Stadler (2001, 2007) Rudolf Haller (1985, 1986), Michael Friedman (1999) and others.

notions and principles, to what extend is metaphysics indispensable in the methodological evaluation of scientific activity? How can one modify, or redefine the verifiability principle in order to incorporate it as a methodological tool? Is there such a possibility at all? The inquiry of this dissertation will revolve around these issues.

In such a way, this dissertation will investigate the relationship between scientific activity and metaphysics in the light of the Vienna Circle's discussion on the subject. In this respect, the approach of Otto Neurath, one of its key members, will be evaluated in detail. Such evaluation will allow to extract certain heuristics from Neurath's position, which will be taken as his 'heritage' for successor philosophers of science, particularly, for Quine's naturalism. In any case, this dissertation will try to incorporate Neurath's contribution to the modern discussions in the philosophy of science. Taking on account the fact that certain metaphysical aspects of scientific activity, such as conventions or other theoretical assumptions, which are not explicitly derivable from experience, but at the same time are unavoidably incorporated in the scientific activity, this dissertation will aim at analysing how metaphysics is indispensable for an effective understanding of science. In other words, it appears quite beneficial to examine to what extend metaphysics is permissible in order to interpret the theoretical content of science successfully and still maintain an empiricist attitude[6] towards the developments in science.

In the aim to fulfil the formulated inquiry, this dissertation is divided into four chapters. Chapter 2 provides an insight on the scientific, philosophical and socio-political background of the Vienna Circle in the beginning of the twentieth century.

[6] By the 'empiricist attitude' that is mentioned here and will be referred to in the following pages of this dissertation, it is presupposed that one of the constitutive components of scientific knowledge are physical objects, particularly their appropriate representation and incorporation in scientific theories. Once accepted, this empirical component should be preserved and promoted in the attempted formulation of an adequate understanding of scientific inquiry. Thus, the main tenet of empiricism, which roughly states that 'all knowledge comes from experience' should be understood in this, narrowed-down context. The general advantages and pitfalls of empiricism as a philosophical position are not addressed here.

This will help to understand the factors that inspired the members of the Vienna Circle to develop their 'innovative' standpoints. Furthermore, the views of the members of the Vienna Circle on such key aspects as the principle of verifiability and the critique of metaphysics, the protocol sentences debate and the analytic/synthetic distinction will be described. This will not only demonstrate the one-sidedness of the standard interpretation of the Vienna Circle, but will also help to reveal the promising legacy of this movement to the contemporary philosophy of science. As the crucial contribution to such legacy, Chapter 3 will be fully devoted to the life and works of Otto Neurath, one of the leading members of Vienna Circle. Here Neurath's non-foundationalist approach in philosophy will be described, maintained through his physicalist account of scientific activity and his rigorous attack against accepting any metaphysical term, notion or doctrine in the scope of scientific enterprise. Moreover, the importance of social, economic and political factors, underlined by Neurath in his approach by the 'ship at the open sea' metaphor, will be pinpointed. Such analysis will allow to extract the promising aspects of Neurath's approach for comprehending scientific activity. This heritage of Neurath will be taken as a basis for the further investigation. Particularly, in Chapter 4, Neurath's heritage will be assessed through its similarities with the position of Willard van Orman Quine, one of the greatest contemporary philosophers of science. This chapter will assess the affinities (and differences) between Neurath's non-foundationalism and Quine's naturalism, so that one can understand, more accurately, how Neurath's approach, being no less, and in some aspects even more efficient than that of Quine, should not be neglected among its successors, who attempt to develop an up-to-date, sensitive, and at the same time adequate inventory for evaluating scientific enterprise. And lastly, Chapter 5 will summarize the analysis conducted in the previous chapters. Here, the limitations of the standard interpretation of the Vienna Circle will be underlined once again, since such a one-sided understanding of this remarkable group restricts the functionality and applicability of its position to the contemporary philosophy of science. In this respect, the heritage of Neurath's approach will be reformulated, emphasising all its appealing aspects. Taking on account the main limitation of Neurath's

philosophical position, which is detected in the tension between Neurath's encompassing non-foundationalism and his radical anti-metaphysical stance, this chapter will describe how certain metaphysical considerations, though not being strictly grounded on experience, are crucial for the process of scientific development. In line with the questions addressed above, a possible modification of Neurath's approach will be provided, which will attempt not to conflict with its non-foundationalist attitude and at the same time allow for the heuristic role of metaphysics. Lastly, an effort will be made to formulate the main aspects of a viable but non-restrictive understanding of rationality in science, and to introduce an alternative for the contemporary account of scientific reliability.

Before proceeding, a remark should be made on the general character of analysis presented in this dissertation. It should be noted that the aim here is not to defend any particular thesis or position in the philosophy of science, such as scientific realism, conventionalism or instrumentalism. Neither it is attempted to advocate for the account that only external factors of scientific activity, referred to as socio-political and economic factors, are the primary and the sole characteristics that determine the path of scientific development. Rather, what is primarily stressed throughout this dissertation is that scientific inquiry is a very complex process, which cannot be comprehended by any normative account, either realist or anti-realist. The only aspect which is not denied here to any extend is the general belief in empiricist conception of scientific knowledge. Thus, instead of limiting one's scope of evaluation to a particular method or philosophical tradition, this dissertation attempts to formulate an efficient account of scientific rationality based on the fruitful aspects of Neurath's non-foundationalist approach, which, as will be shown in the chapters below, allows to incorporate a quite sensitive inventory in the process of evaluation of scientific activity. In other words, the analysis conducted in this dissertation attempts to show that the inescapable aspiration of a philosopher to order every position under a certain, strictly defined label of classification can easily clash with actual efforts and operations of scientists, whose commitments and accomplishments substantially constitute the process of

establishing scientific ‘knowledge’ and its reliability. To avoid this, it is intended here that the examination of this complex process without the burdens, or restrictions of any philosophical categorisation allows to feature more tools in the evaluative inventory, and, as a result, helps to maintain an account that is more delicate to the actual scientific activity. One should definitely consider this while examining the heritage of the Vienna Circle in general, and the promising character of Neurath’s approach in particular.

CHAPTER 2

THE VIENNA CIRCLE: GENERAL BACKGROUND OF THE MOVEMENT

2.1. Influences in The Formation of the Vienna Circle

In order to re-establish the valuable heritage of the Vienna Circle as sensitively as possible, the historical process of its formation, flourishment and disintegration should be examined in some detail. Thus, in the aim of unfolding the promising factors of the Vienna Circle's approach and exposing the shallowness of the standard interpretation of this movement, this chapter will deal with the general background of the Circle's formation and activities, from the early 1900s till its dissolution in Austria in 1938. First of all, the developments in exact sciences in the beginning of the twentieth century will be described. This description will be followed by the exposition of the status of philosophy, namely the philosophy of science, at the early 1900s. In addition, the role of the Enlightenment will be briefly discussed. All this will provide necessary material to introduce the early discussion group (or "the first" Vienna Circle) organized around Philipp Frank circa 1907 and to understand its agenda more accurately. After that, the views of "the official" Vienna Circle will be presented, in two ways. At first, it will be shown how the members came together in a 'circle', and what were its activities throughout that official period. Particularly, the efforts of *Verein Ernst Mach* will be mentioned and the account of the *Manifesto* of the Vienna Circle will be provided. Then, the fundamental apparatus of the Circle will be introduced, underlying its most important aspects, such as the principle of verifiability, the rejection of metaphysics and the protocol sentences debate. Lastly, a general discussion on the matters presented in the chapter will be carried out. Here one will be able to trace the

heritage of the Vienna Circle in the new light, without the limitations of the standard interpretation, also known as logical positivism.

2.1.1. Scientific Developments at the Beginning of the Twentieth Century

It will be reasonable to point out that the need for the improvements in the philosophy of science at the beginning of the twentieth century were necessitated by the progress in exact sciences. At that time, many branches of scientific inquiry were flourishing. Since the main concern of this section is to trace the aspects that produced an impact on the formation of the Vienna Circle's view, certain achievements will be described in detail. In particular, the description will begin with the discoveries in geometry and physics, followed by a brief summary of the accomplishments in logic and mathematics, specifically the efforts for logicism and axiomatics.

The development of non-Euclidean geometries[7] had shown that there existed alternatives to Euclid's understanding of space. Interestingly, non-Euclidean conceptions of space were developed out of Euclid's (problematic) fifth postulate[8]. The demonstration of this postulate, which was not as self-evident as other four, was occupying geometers for a long time. In fact, two different mathematicians, Janos Bolyai (1802-1860) and Nikolai Lobachevski (1792-1856), independently pointed out that the efforts on the demonstration of the fifth postulate allowed for a construction of other geometries. Particularly, not only Lobachevsky's attempt to derive a valid demonstration of the postulate by incorporating *reduction ad absurdum (raa)* ended in contradiction, but also helped him to formulate his version

[7] Namely, hyperbolic geometry developed by Nikolai Lobachevsky in *On the Principles of Geometry* (1829-30) and, independently, by János Bolyai in *Appendix Explaining the Absolutely True Science of Space* (1831); elliptic geometry developed by Bernhard Riemann in *On the Hypotheses which Underlie Geometry* (1854).

[8] The fifth postulate is also known as the "parallel line postulate", which can be defined as "through a given point there is not more than one parallel to a given straight" [Poincaré, 1921: 55].

of hyperbolic geometry. In his *raa* attempt, Lobachevski aimed at the demonstration of the fifth postulate by assuming that "through a given point two parallels can be drawn to a given straight", to obtain a contradiction and thus prove the validity of initial postulate [Poincaré, 1921: 56]. Surprisingly, Lobachevski did not arrive at any contradiction; instead, he succeeded to develop a number of theorems in support of his (new) geometry. In addition to the impediments of the fifth postulate, Bernhard Riemann (1826-1866) showed that Euclid's first postulate, which claimed that "only one straight line can pass through two points" could be overcome as well [Poincaré, 1921: 57]. Riemann's spherical (elliptic) geometry characterized cases where no straights could be drawn from two given points.

However, the new geometries had their problems. Since geometries of Bolyai, Lobachevsky and Riemann allowed for numerous conceptual (and practical) consequences, there was a suspicion among scientists that at a certain point of research a contradiction within these new geometries could be obtained. This factor contributed to the delay in the acceptance of these new geometries. However, Eugenio Beltrami (1835-1900), in his essay, *Teoria Fondamentale Degli Spazii di Curvatura Costante* (1868a) demonstrated that non-Euclidean geometries possessed the same logical consistency as that of Euclid. By introducing the notion of 'curvature', Beltrami proved that the danger of arriving at contradictions could be eliminated. In his terms, new geometries were simply varying in curvatures: Riemann's elliptic geometry was defined as the one with positive curvature, Lobachevski's (Bolyai's) hyperbolic geometry – with negative. This further allowed to represent new geometries in the Euclidean (two-dimensional) space, so their consistency as valid conceptions of space became undiscussable [Poincaré, 1921: 58-9].

The development of non-Euclidean geometries not only demonstrated that there were consistent alternatives to Euclid's conception of space, but also opened a way for the monumental accomplishments in physics. Mechanistic physics, which was

articulated mainly[9] by Isaac Newton (1643-1727) and prevailed as the most consistent physical theory for almost three centuries, was superseded by Albert Einstein's general theory of relativity in 1915. The four-dimensional continuum of space and time, incorporated by Einstein in the articulation of his theory, was based on Riemann's elliptic geometry. Such symbiosis led to the great empirical achievements:

> The new theory explained the motion of the perihelion of Mercury, which was an anomaly for Newtonian theory. Four years later, the new theory received further confirmation from the eclipse experiment in which the predictions of general relativity were shown to be more accurate than those of Newtonian theory [Gillies, 1993: 85].

One should note that the breakthrough in physics on the basis of the new conception of space, occurred at the beginning of the twentieth century, compelled philosophers of science to reconsider the accepted framework of interpreting the process of scientific activity. The reason for this lied mainly in the fact that Euclid-Newton programme, which had gained its reliability and predictive power mainly by means the common-sense experience[10], could no longer be maintained. In other terms, the conception that the main tenets of a scientific theory, verified on the basis of everyday experience, could be treated as incorrigible, irrefutable 'truths' about the world, had to be revised:

> To interpret the principles of science as results of our common sense leads to the opinion that they are self-evident and cannot be refuted by further empirical checking… The belief in Newton's laws as results of the simple experience of everyday life had been bolstered up during the eighteenth and a great part of the nineteenth century… With the new physical theories of the twentieth century, non-Euclidean geometry, relativity and the quantum theory, the belief practically

[9] The term 'mainly' is used here not in order to belittle Newton's contribution, but rather to underline the fact that the process of 'Copernican Revolution' in physics, which was triumphed by Newton's laws of mechanics, incorporated the efforts of other great scientists as well, such as Tycho Brahe (1546-1601), Johannes Kepler (1571-1630) and Galileo Galilei (1564-1642).

[10] Consider, for example, the 'firm' belief that heavy objects fall to the ground in straight patterns due to the pull to the centre of the Earth (gravitational centre), or the law of inertia. These examples appear to conform well with everyday experience. For details, see Frank (1948), p. 276.

> disappeared that the basic principles of physics ought to be plausible according to the criteria of common sense [Frank, 1948: 277].

In this respect, Kant's attempt to put forward a solid, 'universally true' philosophical approach in order to validate Euclid-Newton scientific framework could no longer be treated as a viable position[11].

Apart from the developments in geometry and physics, important discoveries were made in the field of logic and mathematics. German logician and mathematician Gottlob Frege (1848-1925) made crucial elaborations in logic and mathematics by establishing his "term logic" [Zalta, 2018]. Roughly speaking, Frege's term logic consisted of the formal system that treated predicates (of objects) as denoted functions of concepts (i.e., "the predicate calculus") [Zalta, 2018]. By means of the formal system, Frege demonstrated the possibility of denoting (building a valid inference of) every expression in a language. For instance, the statement 'Kevin is happy' could be re-written, according to Frege's formal system, in the form '(H(k))', where 'k' was the object in question and '(H( ))' – the function of the concept '( ) is happy' [Zalta, 2018]. By incorporation of logical connectives (conjunction, disjunction, negation, etc.) and logical quantifiers ('All…' 'Some…') one was allowed to analyse more complex structures. In such a way, there emerged an opportunity to reconstruct object-predicate relations in purely formal terms, by means of this new logic (i.e. demonstrate their *reducibility* to logic). Frege's contribution to mathematics was made in this respect. On the foundation of his formal system, Frege attempted to demonstrate the reducibility of theoretical mathematics to simpler logical and mathematical terms [Zalta, 2018]. This attempt gave birth to the movement of logicism, or

> … The idea not only that mathematical concepts can be defined in terms of purely logical concepts but also that mathematical principles can be derived from the laws of logic alone [Zalta, 2018: section 2.4.2].

[11] The philosophical aspect of the issue is examined in more detail in sub-section 2.1.2. below.

The task of logicism had its particular influence on the work of Bertrand Russell (1872-1970). Russell's basic aim was to demonstrate that truths of logic and mathematics were purely analytic[12] in order to restore the fruitful aspects of empiricism: by demonstrating the 'pure' analyticity of mathematical and logical propositions, it could be efficiently maintained that all knowledge came from experience; logic and mathematics were in that respect 'empty', they did not assert anything about the world [Gillies, 1993: 12]. In this context, Russell continued the task of Frege; together with Alfred North Whitehead (1861-1947), he generated *Principia Mathematica*, a three-volume treatise published from 1910 to 1913. In general terms, here Whitehead and Russell articulated their account of the new, symbolic logic as an alternative to the predicate (Aristotelian) logic. By incorporating into their account a properly defined set of axioms[13], Whitehead and Russell succeeded to construct a theory of numbers, interpreted mathematical analysis and set theory. This allowed them to conclude that, in principle, mathematics was *reducible* to logic [Russell, 1924/1996: 205]. Thus, Russell achieved his basic aim: accomplishments of *Principia* gave an opportunity to conjecture that mathematics, being reducible to logic, was a formal field of inquiry, i.e. purely analytic in nature (not synthetic a priori as Kant presupposed).

The tendency towards logicism could also be traced in the work of German mathematician David Hilbert (1842-1943), whose attempt of the axiomatization of geometry and mathematics[14] further made an impact on the views of the Vienna

[12] It appears that Russell was not satisfied with Moore's suggestion that truths of mathematics were grasped from experience. That was why he aimed at demonstrating that propositions of mathematics were true by definition, so that no reference to experience was needed to comprehend them. In that context Russell identified them as 'empty' – they were "mere linguistic conventions" [Gillies, 1993: 12]. Associating analyticity with the 'truth by convention' was the main point of Quine's attack of that concept. For details, see chapter 4.

[13] Whitehead and Russell incorporated the axiom of infinity and the axiom of choice.

[14] Hilbert described his idea of axiomatization in *The Foundations of Geometry* (1902) and in *The Foundations of Mathematics* (1927). Although Hilbert's aim was similar to that of logicism, his axiomatization thesis is more frequently classified as formalism. Hilbert himself was not an adherent of reduction [Hilbert, 1927/1996: 237].

Circle [Frank, 1955: 13]. In general terms, Hilbert aimed at the formalization of mathematics and geometry through establishing an unshakeable foundation for these disciplines by means of the pre-defined set of axioms, definitions and logical signs[15], which would further aid to render

> …every mathematical proposition into a formula that can be concretely exhibited and strictly derived, thus recasting mathematical definitions and inferences in such a way that they are unshakeable and yet provide an adequate picture of the whole science [Hilbert, 1927/1996: 228].

Hilbert's aim in defending his axiomatic approach was motivated by the fact that in such a way, the validity of mathematics and geometry could be demonstrated by the logical relationships between axioms and mathematical (geometric) concepts, without appeal to experience [Hilbert, 1927/1996: 239]. In this regard, Hilbert's work was dedicated to the search for the proper basis of axiomatization[16].

That was, basically, the scientific background the Vienna Circle was to build its approach into. As was mentioned a few lines above, the breakthrough in exact sciences at the beginning of the twentieth century shook the foundations of the philosophy of science, formed mostly in accordance with the Euclidean geometry and Newtonian physics. The methodological tools by means of which the scientific inquiry was evaluated were in need of reformation in order to cover the shift from one scientific framework to another. Before exposing the Vienna Circle's attitude as a candidate for such reformation, it is essential to gain some insight into the status of philosophy of science at the early twentieth century. That will be the task of the next sub-section.

---

[15] Particularly, Hilbert mentioned the following: axioms of implication and recursion, axioms about & and v, axioms of negation, the logical ε-axiom – $A(a)\rightarrow A(\varepsilon(A))$, axioms of equality and axioms of number; the definitions that "introduce the notions of mathematics and have the character of axioms"; and logical signs, such as →, &, v, ¯, (x), (Ex) [Hilbert, 1927/1996: 229-31].

[16] As will be specified in the section 2.4. of this chapter, Gödel's work on the incompleteness theorems demonstrated that the consistency of mathematics as a closed (completed) system could not be established successfully. Hence, Hilbert's programme for axiomatization was unsuccessful.

2.1.2. The Status of Philosophy in the Early 1900s

When Immanuel Kant's *The Critique of Pure Reason* was published in 1781, most of the issues and obscurities in philosophy and science seemed to have been resolved. It appeared that, finally, philosophers succeeded to uncover the efficient mechanism for comprehending 'the true nature' of the world, by means of Euclidean geometry and Newtonian mechanics. One can make such a speculation since Kant, while describing the sources of knowledge about external world, placed space and time as the unchangeable and the only possible basis of acquiring such knowledge [Kant, 1929: 66]. The reliability of this basis was ensured by Euclidean space and Newton's conception of time. By incorporating such an understanding of space and time (as pure forms of intuition of the faculty of sensibility), Kant pronounced that it was the unique capacity of human mind to structure phenomenal data and further process it[17] into synthetic a priori judgements, or scientific judgements. That was the only way to obtain credible, reliable knowledge about external world. Thus, Kant believed, the "battle" between rationalism and empiricism could be finally settled down: there was actually no need to separate the subject (the inquirer) and its object (external world) in the process of gaining scientific knowledge, if one could comprehend that it was the unique capacity of human mind to produce synthetic a priori truths all along [Kant, 1929: 138, 147]. There appeared a hope that, eventually, philosophers of science were served with a valid methodology that could successfully analyse every case in scientific practice.

However, the matters did not proceed as cloudlessly as it was hoped for. The achievements in exact sciences at the beginning of the twentieth century demonstrated that Kantian approach for comprehending the process of scientific activity, which treated Euclidean geometry and Newtonian mechanics as

[17] The 'processing' was performed, in Kantian terms, by means of concepts of the faculty of pure understanding. For details, see Kant (1929), "Transcendental Logic" section.

indisputably reliable truths about space and time, was insufficient. It was apparent that, despite Kant's endeavours in bringing rationalism and empiricism together, his epistemological thesis had inconsistencies which had to be fixed.

An attempt to improve Kant's theory of knowledge was made by the members of the Marburg School[18], also known as the part of Neo-Kantian movement that was spread in the 1860s. In particular, Ernst Cassirer, one of the members of the School, maintained that the developments in science necessitated a shift in Kant's understanding of knowledge-making process. He agreed with Kant that the main epistemological concern was to guarantee the objectivity of scientific knowledge, coming from a subjective source [Gower, 2000: 87]. On the other hand, the progress in exact sciences at the beginning of the twentieth century indicated that the faculty of pure intuition, the reliability of which was established by means of Euclid-Newton framework, had to be abandoned [Gower, 2000: 92]. For this reason, Cassirer decided to reformulate the notion of concepts of pure understanding, which stood as the subjective warrants of (scientific) knowledge [Cassirer, 1996: 9; 19]. Taking on account the "new" logic (i.e. symbolic logic developed by Frege, Whitehead and Russell), Cassirer inferred that the appropriate foundation for synthetic a priori judgements should not be established by concepts formulated as mere abstractions from particulars[19]. Rather, such foundation should be furnished by concepts that depicted *relations* between phenomena. In this respect, Cassirer defined these elaborated concepts as *functions*[20], by means of which relations among phenomenal manifold were structurally established for the constitution of objective reality [Cassirer, 1996: 21]. In such a way, Kantian belief that scientific knowledge was formed by means of synthetic a priori judgements could be preserved.

[18] The Marburg School was represented by Ernst Cassirer (1874-1945), Paul Natorp (1854-1924) and Hermann Cohen (1842-1918).

[19] That was how Cassirer (1996) described scholastic (Aristotelian) definition of concepts.

[20] Here one can consider systematic operations performed by mathematical functions.

As will be shown in the following sections of this chapter, this kind of modified foundationalism of Kantian synthetic a priori knowledge would not convince the members of the Vienna Circle. In fact, the discussions about the doctrines of logicism and formalism in mathematics and logic would result in the total rejection of Kant's understanding of the "synthesis of knowledge a priori", notwithstanding the elaborations of the Marburg School. In this context, the mature views represented within the Vienna Circle would advocate for the strict distinction between analytic and synthetic propositions, the former being a priori and the latter – a posteriori[21].

Before proceeding, a small remark on Kant's efforts should be made. In *The Critique of Pure Reason*, one will be unable to find that Kant strictly identifies, or defines space as Euclidean and time as Newtonian[22]. Thus, it can be conjectured that Kant did not pronounce neither logical, nor physical necessity of Euclid-Newton scientific framework. It would be more appropriate to claim that this framework was privileged as the most well-established theoretical set for the foundations of scientific knowledge. Even if Kantian original position can no longer be maintained as a fruitful methodological and epistemological tool, one should not underestimate the importance of Kant's efforts. One of Kant's main goals was to grasp how human understanding operated in the knowledge-making process, what were the mechanisms of such a process. He tried to achieve this goal by appealing to scientific knowledge, without further postulating of highly abstract concepts, such as 'the Absolute', 'Omnipotence', etc. In short, it can be inferred that the significant role of human-being as an active 'creator' of knowledge in the process of scientific inquiry, underlined by Kant, was unjustly misunderstood by most of its successors.

---

[21] For the detailed discussion on the members' views about the distinction, see section 2.4. of this chapter, especially sub-section 2.4.4.

[22] From *Prolegomena to Any Future Metaphysics That will be Able to Come Forward as Science* (1783), one can infer that Kant presupposed space to be Euclidean and time should be referenced in accordance with Newton's physics. Still, no direct definition from Kant's writings could be obtained.

2.1.3. The Role of the Enlightenment

Apart from the changes occurring in science and philosophy, there was another, historical aspect which had its influence on the formation of the Vienna Circle's approach. This aspect can be identified with the movement of Enlightenment, which began in the seventeenth century Europe, although no strict initiation dates could be provided. In this respect, one can refer to René Descartes's *Discourse on the Method* (1637) as one of the earliest philosophical works of the Enlightenment [Outram, 2006: 14]. Philipp Frank, in his *Modern Science and its Philosophy* (1955), associated the beginning of Enlightenment with the period of Scientific (Copernican) Revolution, or the downfall of Ptolemaic astronomy and the abolishment of Aristotelianism (scholasticism) in physics by the efforts of Galileo, Newton and Einstein [Frank, 1955: 73-74].

It is remarkable that, although many of the great minds made their contribution to the movement, no sharp definition of the term 'Enlightenment' (French: *les Lumières*; German: *Aufklärung*) can be provided [Outram, 2006: 10; 24]. One possible explanation for this is that the movement spread in slightly different time periods across Europe. Very generally speaking, the movement of the Enlightenment aimed at the fight against religious superstition[23], which then extended to the fight for the separation of the state and church (John Locke), rationality and freedom of thought (René Descartes, Immanuel Kant, Isaac Newton) and liberty (Thomas Hobbes, Jean-Jacques Rousseau). To put it in Kant's words, "*Enlightenment is the human being's emancipation from its self-incurred immaturity*" [Kant, 1784/2006: 17].

One of the essential symbols of the Enlightenment was the *Encyclopédie, ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers* (*Encyclopedia, or a*

[23] i.e. beliefs in the existence of angels, demons, witches, devil, etc., questioned by the works Spinoza, Leibniz, Voltaire, and others.

Systematic Dictionary of the Sciences, Arts, and Crafts) published in Paris between 1751 and 1765 under the editorship of Denis Diderot and Jean-Baptiste le Rond D'Alembert. The *Encyclopédie*, published in 17 volumes, contained thousands of scientific articles and engravings [Outram, 2006: 46]. This further inspired Otto Neurath to comprise the Encyclopaedia of the Unified Science[24].

It is interesting to note that the bloom of the Enlightenment, historically, was usually either juxtaposed with radical 'shifts' of accepted order and attitudes (Copernican Revolution, for instance), or was followed by actual political and cultural shifts (such as the Glorious Revolution in Britain (1688) or French Revolution in 1789–1799). In such a way, one could conceive that the fight of Enlightenment of the eighteenth century was not futile; the arguments spread by the Enlightenment did not remain as a pointless "intellectual talk". Thus, it left for its successors the hope that the defence of rational, just, 'enlightened' attitude was an effective mean to maintain a viewpoint of life, protect and spread it despite the circumstances. Since the development of the Vienna Circle occurred in the background of the dissemination of Nazism in Central Europe, it should be stated that the circumstances did not favour much the freedom of thought [Haller, 1986/1991: 48]. Thus, the Vienna Circle's fight against metaphysics did not only target 'old-school' philosophy, it also embraced the tenets of the Enlightenment in the wider scope:

> In the inter-war period, the anti-metaphysical attitude of the Vienna Circle served mainly as an intellectual weapon against the rampant irrationalism and the idealistic speculation and ideology of the authoritarian universalism of Othmar Spann and his intellectual adherents in Austro-fascist intellectual life [Menger, 1982. Quoting from Stadler, 2001: 468].

The ideas of the Enlightenment were carried to Austria through the works of remarkable Austrian philosophers, such as Bernard Bolzano (1781-1848), Franz Brentano (1838-1917), and Ernst Mach (1838-1916) [Haller, 1986/1991; Stadler,

[24] A further mentioning of Neurath's Encyclopaedia can be found in chapter 3.

2001: 88-92; Frank, 1955: 78]. Especially, Mach's attitude against metaphysics, as it was contrary to the economic function of science, was one of the topics discussed within the early Vienna Circle[25].

Returning to the general discussion of the Enlightenment, by what means were its ideas spread among people? Talks, conversations and discussions were crucial communicational tools in sharing the tenets of the movement. Apart from theatres, lobbies and cafés, tea and coffee houses in London, Paris and Vienna made an important contribution by providing space for such intellectual discussions [Outram, 2006: 56]. In 1907, in one of these coffee houses in Vienna, a group of scientists and philosophers initiated regular discussion meetings about contemporary issues in science and its philosophy. Rudolf Haller (1985/1991) named the group as the "first" Vienna Circle. This early discussion group is examined below in detail.

2.2. The "First" Vienna Circle: Filling the Gap Between Science and Its Philosophy

The story of the First Vienna Circle began in 1907, when Philipp Frank obtained his PhD in philosophy of physics at the University of Vienna. Together with the team of students, Frank initiated a discussion group which met at a Vienna coffee house on Thursdays, with the participation of Hans Hahn and Otto Neurath [Frank, 1955: 1-3]. The main interest of the discussion group lied, among other topics, in the status of the philosophy of science in the light of the new discoveries in exact sciences. As was remarked earlier, Kant's theory of knowledge, based on the unchangeable concept of synthetic a priori, could no longer be treated as a feasible position. In such a way, the group was discussing other alternatives to fill the

[25] The 'first' Vienna Circle is described in detail below, in section 2.2. of this chapter.

explanatory gap between science and its philosophy. The emergence of such a gap, as the group believed it, lied in the following:

> Two characteristic beliefs of nineteenth-century science broke down during its last decades; these were the belief that all phenomena in nature can be reduced to the laws of mechanics, and the belief that science will eventually reveal the "truth" about the universe [Frank, 1955: 4].

Thus, the proto-Circle was looking for an alternative account of interpreting scientific activity in a way to avoid any mechanistic explanations, as they became 'démodé' in the light of the developments in science at the beginning of the twentieth century. Moreover, such alternative, as the group presupposed, needed to be generated without any appeal to unchangeable foundations in seeking objectivity of scientific inquiry (contrary to Kantian conception of synthetic a priori).

Since the discussions of the first Vienna Circle were interrupted by the World War I, it cannot be claimed that these negotiations came to fruition in the form of a completed and well-integrated position. Rather, the discussions in the proto-Circle served as "intellectual forecasts", or detailed examinations of different philosophical positions, mainly those of Ernst Mach (1838-1916), Henri Poincaré (1854-1912) and Pierre Duhem (1861-1916), which would further (if not interrupted by the war) aid in constructing a viable methodological approach of the group [Haller, 1985/1991: 97]. Thus, the description of the works of these philosophers will help to render (at least) the general characteristics of the proto-Circle's view. Moreover, as will be dealt with in the concluding section of this chapter, the discussion of these works within the proto-Circle will help to unwrap the one-sidedness and incompleteness of the standard interpretation of the Vienna Circle [Haller, 1985/1991: 99]. For this reason, the summaries of the views of Mach, Poincaré and Duhem are provided below.

The philosophical position of Mach was important for the discussion in the first Vienna Circle from several aspects. Mach's view, as one of "the mightiest force of

new Enlightenment" [Frank, 1955: 78] was crucial for the formation of the group's anti-metaphysical attitude. Mach's rejection of metaphysics, or "the elimination of the trans-empirical" [Stadler, 2001: 165], as the proto-Circle took it, was closely connected to his conception of the unity of science [Frank, 1955: 84]. This conception was, subsequently, based on Mach's definition of the economy principle. In turn, by incorporating these notions together with the critique of language, the early Circle's understanding of Mach's positivism could be established. Therefore, it would be crucial to examine these features in Mach's theory in some detail.

It can be affirmed that Mach's anti-metaphysical attitude towards science incorporates harmoniously all aspects of his position, such as the theory of elements, the principle of economy and the unity of science. According to Mach, the fundamental epistemic constituents of the world were sensations[26] [Mach, 1890: 61]. All objects of inner and outer world (including their basic physical characteristics, such as space and time) were formed by different combinations of such sensory elements. The task of science, in Mach's terms, was to describe, structure and classify relations between sensations in the most efficient manner possible. The implementation of this task, as Mach believed, was performed by means of the principle of the economy of thought. This principle came from Mach's conjecture that in order to operate with as many observational facts as possible in the least time- and effort-consuming manner, scientists deduced and utilised theories as conceptual, *economical* tools, or quantitative 'shortcuts'. In such a way, science was an economical scheme for representing various relations among sensations by means of the formal (functional) laws:

> …Within the short span of a human life and with man's limited powers of memory, any stock of knowledge worthy of the name is unattainable except by the *greatest*

[26] It should be remarked that sensations, as the ultimate constituents of knowledge should not be treated as permanent, or metaphysical foundations of the world [Mach, 1890: 68]. Rather, Mach's phenomenalist view intended to delimit the bottom line, the starting point of human knowledge. In this respect, Mach stressed the promotion of the physiology of the senses, by means of which the proper understanding of sensations as elements could be established.

> mental economy. Science, itself, therefore, may be regarded as a minimal problem, consisting of the completest possible presentment of facts with the *least possible expenditure of thought* [Mach, 1893/1960: 586].

In such a way, science was, for Mach, "experience, arranged in economical order" [Mach, 1882/2014: 197]. Every principle, law, and abstract assumption served the function of economy, or "facilitating our mental reconstructions of facts" [Mach, 1893/1960: 606]. Statements such as 'every event has a cause', 'the angle of refraction is equal to the angle of incidence', 'speed of light is constant", all were hypotheses serving the economy of representation, they did not have any intrinsic, substantial existence. In this context, Mach's understanding of scientific activity had pragmatic, or functional value. Thus, it can be inferred that Mach's principle of economy underlined his anti-metaphysical, positivist attitude towards science.

A simple example can deliver Mach's understanding of the economy in science. Imagine an organism, well-structured and well-adapted to the living (operation) conditions. In these circumstances, it will be adequate to assume that every part of the organism has a special function, economic "assignment", so-to-speak. If wings are functional for that organism, then wings will be present. If forty limbs are not functional and two can do the job well, then the organism will have two limbs. Following this analogy, science can also be treated as an organism, constantly expanding and accumulating its economic (functional) tools. It can be stated that science is in the continuous process of evolution – it moderates the existing tools and discovers new ones, aiming at the construction of a perfectly adapted 'organism'[27]:

[27] Here it should be remarked that, although it may appear that the relation between Mach's definition of the economy of thought and evolutionary approach is harmonious at the first glance, this relation can be suspected of involving a circular reasoning. At the one hand, the evolutionary approach is preferred since it serves well the function of economy. At the other, this function of economy is established through adaptative mechanisms of evolution, in order to constitute a well-fitted 'organism'. For details on this issue, see Berkovski, (2019), p. 5, 8.

> The transformation of ideas [thus] appears as a part of the general evolution of life, as a part of its adaptation to a constantly widening sphere of action [Mach, 1883/2014: 233].

In such a way, the ultimate goal of science, according to Mach, would be to accomplish the *unity*, or the perfectly adapted, the most economic reconstruction of the world [Mach, 1882/2014: 207]. For this reason, Mach treated science as the historically developing process:

> A competent view of the world can never be got as a gift; we must acquire it by hard work. And only by granting free sway to reason and experience in the provinces in which they alone are determinative, shall we, to the weal of mankind, approach, slowly, gradually, but surely, to that ideal of a *unified* view of the world which is alone compatible with the economy of a sound mind [Mach, 1893/1960: 560].

The uselessness of metaphysical assertions was accepted by the first Vienna Circle as the main implication of Mach's principle of economy and the goal towards unified science [Frank, 1955: 82-5]. In this respect, the role of the critical analysis of language was crucial [Stadler, 2001: 121; Haller, 1985/1991: 104]. As the early Vienna Circle interpreted it, science should be expressed in the strict language, following the principle of economy[28]. The abstract theoretical terms used in the language of science, such as 'wave', 'energy', 'force', etc., were introduced in a theoretical framework, *where necessary*, as functional 'tools' to describe relations among phenomena in the economic representation. Consequently, these abstract terms did not possess any independent epistemological value. In this respect, the pronunciation of the ultimate "truths" of the old, mechanistic (Aristotelian) explanations, treated by the proto-Circle as responsible for the emergence of the gap between science and philosophy, could be avoided [Frank, 1955: 68].

In such a way, the first Vienna Circle negotiated the alternatives for re-establishing the connection between science and philosophy by means of Mach's positivism.

[28] The proto-Circle believed that non-functional terms, such as 'absolute' or 'ultimate cause' should be avoided in order to preserve "the simplest system of propositions" [Frank, 1955: 86].

However, the proto-Circle was also aware that the accomplishments in logic and mathematics, which specified these branches of science as purely analytic (i.e. without any reference to experience), put a constraint in application of Mach's phenomenalistic position:

> We felt strongly that there was a certain gap between the descriptions of observations, necessarily vague and complex, and the principles of science, consisting, in physics particularly, of a small number of concepts (like force, mass, etc.) linked by statements of great simplicity. We admitted that the gap between the description of facts and the general principles of science was not fully bridged by Mach, but we could not agree with Kant, who built this bridge by forms or patterns of experience that could not change with the advance of science [Frank, 1955: 8].

How could a viable connection between science and philosophy be re-established, if the claim that *all* scientific statements should be reducible to perception terms could no longer be strictly followed? In this direction, the proto-Circle discussed Poincaré's conventionalism and Duhem's holism as facilitating the most efficient re-connection tools [Stadler, 2001: 145; Friedman, 1999: 83; Haller, 1985/1991: 99].

Poincaré's conventionalist position served the first Vienna Circle with the following fruitful aspects. According to Poincaré, the 'knowable' world was represented by scientific theories, in the form of theoretical (mathematical) structures that established relations among phenomena [Poincaré, 1921: 28]. The basic assumptions (such as the axioms of geometry) on the foundation of which such mathematical structures were elaborated, were "*neither synthetic a priori judgements nor experimental facts*. They [we]re *conventions* […], *merely disguised definitions*" [Poincaré, 1921: 65]. In other words, the conventional commitment of a scientist to a particular theoretical basis allowed for the construction of a certain mathematical structure, or scientific framework[29]. In order to preserve the bearing

[29] For instance, if one chooses Euclidean geometry, Newtonian mechanics can be built and put forward as a theoretical framework for representing relations among phenomena. On the other hand, if one prefers axioms of non-Euclidean geometry, a totally different structure can be described.

to objective reality, Poincaré maintained that experience was the only appropriate guide for the selection of the most efficient conventional basis; in that respect, scientific frameworks did not determine the ultimate 'truth' about objects, they were rather preferred due to the greater level of accommodation of empirical relations [Poincaré, 1921: 79-80].

In general terms, Poincaré's conventionalism furnished the first Vienna Circle with the following promising factors. Firstly, the limitation of Mach's positivism regarding developments in logic and mathematics at the beginning of the twentieth century could be overcome, since, without positivist restriction that every scientific proposition should represent sensuous relations, the new logic of Whitehead and Russell was allowed to be conventionally accepted as the conceptional basis of science. And secondly, the status of all basic assertions and principles in science could be identified as conventional, or 'functionally' a priori, for the sake of greater empirical success of the whole theoretical framework these assertions were posited for [Frank, 1955: 10]. Thus, Mach's anti-metaphysical attitude could be preserved since rendering scientific knowledge on the basis of selected conventional set did not presuppose any ultimate epistemic commitment about 'truth' or 'reality' of the external world.

The fact that not all components of a scientific theory could be in principle expressed in terms of experience (i.e. could be reduced to basic sensuous experience) was further enhanced by the proto-Circle's discussions of Duhem's holism. Duhem defined scientific theories as sets of orderly (mathematical) propositions, which aimed ultimately "to represent as simply, as completely, and as exactly as possible a set of experimental laws", mirrored in the predictive success of these theories [Duhem, 1954: 19, 31]. The implementation of this aim was facilitated through the particular structure of scientific theories, which was, according to Duhem, more complex than a simple system of theoretical generalizations from phenomena. In order to elaborate an appropriate systematisation of certain empirical data, scientists incorporated a variety of

theoretical tools, such as basic principles and definitions, auxiliary assumptions, theories of measurement and those of existing theoretical background. In this context, Duhem suggested to interpret scientific theories as composite *wholes* of logically connected theoretical representations, correlated with experimental laws [Duhem, 1954: 147, 168, 205]. Therefore, the process of scientific test was, in Duhem's terms, a challenging and effort-consuming procedure: the presence of a single recalcitrant evidence could not falsify a theoretical whole in question, it could only indicate that there was an inconsistency existing in that whole. In other words, that was how Duhem criticised the inefficiency of *experimentum crucis*, which could also be defined as 'Duhem's thesis':

> …the physicist can never subject an isolated hypothesis to experimental test, but only a whole group of hypotheses; when the experiment is in disagreement with his predictions, what he learns is that at least one of the hypotheses constituting this group is unacceptable and ought to be modified; but the experiment does not designate which one should be changed [Duhem, 1914/1954: 187].

The members of the early Vienna Circle agreed with Duhem's attack on the idea that a certain isolated scientific theory could be rejected by a single contradictory evidence [Frank, 1955: 15]. In that respect, Duhem's holist account of scientific activity allowed the proto-Circle to realise that "the experimental verifications are not the basis of the theory, but its culmination" [Frank, 1955:15-16]. It can be inferred that the comprehensiveness of Duhem's thesis convinced the first Vienna Circle that due to the complex structure of scientific theories, Mach's excessive positivism expressed in the primacy of sensational terms was untenable.

As the World War I broke in Europe, the discussions of the First Vienna Circle were interrupted. Hahn, Frank and Neurath agreed to continue these discussions whenever it would become possible, but on a wider ground and, desirably, under the mentorship of a professor in a university [Menger, 1980: ix]. As will be demonstrated in the next section, the agreement was realized as desired, under the leadership of Moritz Schlick at the University of Vienna. Although the discussions

of the 'official' Vienna Circle were carried in the slightly different plane[30], the importance of the proto-Circle should not be neglected. First of all, the critique of metaphysics or the rejection of everything "trans-empirical", as it was formulated by Mach and carried into the early Circle, was accepted throughout the period of existence of the official Circle. And secondly, the discussions of the views of Mach, Poincaré and Duhem not only served as the specific guidelines for the Circle's further elaboration of its approach in science, but also had a particular influence on Neurath's account, which remained unique throughout the official stage of the Vienna Circle[31].

2.3. The 'Official' Vienna Circle

2.3.1. General Remarks: People, Activities

The history of the official Vienna Circle began in 1921, when Hans Hahn took the chair of mathematics at the University of Vienna [Stadler, 2001: 195]. When, in 1922, the chair of philosophy of the inductive sciences became vacant, Hahn saw the opportunity to continue the discussions of the early Circle, as the conditions for that appeared suitable (upon Frank, Neurath and Hahn's agreement to continue the group discussions in the university). For this reason, mainly by Hahn's efforts, Moritz Schlick was offered the chair [Menger, 1980: ix]. As the head of philosophy department at the University of Vienna, Schlick organized a small discussion group that met on Thursdays at the university campus, with Hahn and Neurath as the key participants [Menger, 1980: x]. At that time, Philipp Frank could not contribute to every meeting as he was the head of physics department at the University of Prague; still, he was participating in the discussions of the newly formed group at least twice

[30] This happened mainly due to the influence by Wittgenstein's *Tractatus*. For details on this issue, see sections 2.3. and 2.4. of this chapter.

[31] As will be described in detail in chapter 3, the uniqueness of Neurath's account will help to carry the promising role of the Vienna Circle to the contemporary philosophy of science.

a year [Menger, 1980: x]. In 1923, Viktor Kraft (at that time the librarian at the University of Vienna) and Kurt Reidemeister (German mathematician and geometer) joined the discussion group [Menger, 1980: x]. Starting from 1924, by the suggestion of Schlick's students, Herbert Feigl and Friedrich Waismann, the meetings of the "Schlick Circle" (or soon-to-be the 'official' Vienna Circle) were fixed to be held every Thursday on the regular basis, at the University's Institute of Mathematics building [Stadler, 2001: 198-9]. In 1926, Rudolf Carnap, philosopher and logician from Jena, joined the group as he received a teaching position at the University of Vienna. Towards 1928, Hahn's students, Kurt Gödel and Karl Menger were introduced into the Thursday meetings [Uebel, 2014: 6]. In such a way, it could be claimed that the main group of contributory members of the official Circle was established.

Although all of the members of the Schlick Circle were interested in discussing the place and status of philosophy in the light of the developments in exact sciences, they all had specific academic interests at the time the meetings were organized. Specifically, Frank was interested in the philosophy of physics and was investigating the concept of causality, while Neurath specialized in economy, sociology and history. Hahn, as a mathematician, was examining the new logic of *Principia* and the doctrine of logicism, whereas Schlick, as Planck's student, was concentrated on Einstein's theory of relativity and philosophy of nature. Lastly, Carnap, student of Frege in Jena, was well acquainted with the developments in logic and had interests in the formal view of the philosophy of science [Menger, 1980: x]. Such diversity in the academic backgrounds aided for the rich, wide-ranging discussions within the Circle[32]. In addition to this, it demonstrated that the evaluation of the Vienna Circle should not be performed as if all the members were in agreement on every aspect of their conversations: it would be more proper to speak about the *views* of the Vienna Circle, since, apart from the general

[32] As will be shown in the section 2.4., the discussion about the status of the protocol sentences will even split the members on "wings".

motivational lines, the members of the group advocated for their particular understandings on the issues discussed.

So what were they discussing, and what were the 'general motivational lines' of these discussions? Leaving the detailed examination of the Vienna Circle's views to the section 2.4., here are some preliminary remarks. First of all, the members of the Circle were well aware of the fact that the accomplishments in the exact sciences necessitated certain elaborations in philosophy, namely in the philosophy of science. In this respect, the discussions of the first Vienna Circle played a role, as via them the views of Mach, Poincaré and Duhem were delivered to the Official Circle [Stadler, 2007: 24]. Most importantly, the 'spirit' of Enlightenment as was projected by Mach's principle of the unified science and, especially, the elimination of metaphysics, was acquainted and became the common motivational line among the Vienna Circle's arguments:

> [Mach's] anti-metaphysical attitude, exemplified in his views on absolute space and time, anticipated the statement that only verifiable propositions are meaningful or, to put it somewhat less dogmatically, the positivistic postulate that extra-logical propositions should be verifiable [Menger, 1960: xviii].

The second determining factor of the Circle's discussions came from the interest for the doctrine of logicism, which at that time was at the culminating stage of development. Hahn was the member who turned the Circle's attention to the developments in logic made by Whitehead and Russell [Menger, 1980: x], which opened a new perspective in the issue of reducibility of mathematics to logic in particular, and on searching for the formalist scientific method in general. In this context, Hilbert's axiomatic approach in mathematics and geometry, and the possibility of demonstrating the consistency of mathematics on the basis of the new logic, as described in *Principia*, was discussed in the meetings of the Vienna Circle.

Nevertheless, the most important line of discussions in the group, which further drastically impacted the Vienna Circle's approach in philosophy, came after the

publication of Ludwig Wittgenstein's *Tractatus Logico-Philosophicus* (1921; 1922 in English). In brief, *Tractatus* maintained Russell's understanding of atomic and molecular propositions, as the bearers of meaning, and further extended it by positing that there were only two types of meaningful propositions: factual (atomic or molecular) statements and logical tautologies. It can be conjectured that by proposing such a strict demarcation criterion of meaningfulness, Wittgenstein sought to solve one of the main problems in philosophy of science (i.e. the issue of establishing valid epistemic connections between subject and empirical world).

A number of clarifications should be made with regards to Wittgenstein's view. Firstly, Wittgenstein's understanding of propositions should be provided. Wittgenstein was agreeing with Russell on the point that knowledge about the world was gained via language [Wittgenstein, 2001: 16-29]. Consequently, only the adequate analysis of language and providing a criterion of meaning would allow for establishing an efficient system of true, meaningful, objective statements (about the world) [Mayhall, 2003: 6]. In this respect, elementary propositions were treated as the simplest bearers of meaning, e.g. 'The sun is shining outside'. In Wittgenstein's terms, elementary propositions asserted "the existence of a state of affairs": if a state of affairs existed, an elementary proposition was true, if not – false [Wittgenstein, 2001: 36-7]. The meaning of all other propositions, composite in structure, such as, 'The sun is shining and it is hot outside', were evaluated in accordance with the truth-value of their elementary components. In other words, all statements, or facts, about the world, could be translated, or *reduced*, in terms of meaning, to elementary propositions. For the preservation of the truth value of (composite) statements, Wittgenstein incorporated truth-tables of logical connectives (conjunction, negation, disjunction, etc.), so the simple reference to the truth-table of a connective used in a certain composite statement would reflect the truth value of its elementary constituents [Wittgenstein, 2001: 44-5, 52]. For example, if one wonders the truth value of the statement 'The sun is shining and it is hot outside', it is enough to know the truth value of the elementary propositions it consists of, i.e. 'The sun is shining' and 'It is hot outside'. Since the parts are

connected by conjunction, its truth-table will show that in order for the whole statement to be treated as 'true', both components should be true. In all other cases ('T'∧'F'; 'F'∧'T'; 'F'∧'F') the truth value of the statement will be 'false'. In such a way, for Wittgenstein, propositions were "the truth functions" of its elementary components [Wittgenstein, 2001: 43].

On the other hand, Wittgenstein, following Whitehead and Russell, treated propositions of logic as tautological, i.e. purely formal, analytic statements that were "unconditionally" true [Wittgenstein, 2001: 41, 71]. The efforts towards reducibility of mathematics to the formal grounds of logic had demonstrated its analytic nature as well. In such a way, statements which were classifiable neither as factual, nor as tautological statements, should be treated as meaningless. For instance, 'The scientific knowledge correlates synthetic a priori judgments' or 'God is omnipotent and omnipresent warrant of truth', although having a legitimate grammatical structure, were meaningless, and thus false, since they were neither tautological, nor could they be reduced to proper elementary propositions corresponding to reality of the external world. Wittgenstein even treated the propositions of *Tractatus* as only temporary in building the legitimate understanding of the knowledge of the world:

> My propositions serve as elucidations in the following way: anyone who understands me eventually recognizes them as nonsensical, when he has used them - as steps - to climb up beyond them (He must, so to speak, throw away the ladder after he has climbed up it.) [Wittgenstein, 2001: 89].

The "elucidatory" nature of the propositions in *Tractatus* would become the topic of discussion among the members of the Circle: Neurath and Carnap would see them as metaphysical, thus not permissible in the Circle's approach, while Schlick and Waismann were more loyal to Wittgenstein's view.

Generally speaking, *Tractatus* navigated discussions of the Schlick Circle in the following ways. First of all, the strict demarcation between factual/tautological

propositions allowed to reject the Kantian concept of synthetic a priori and give priority to the sharp distinction between analytic/synthetic statements[33]. Secondly, Wittgenstein's understanding of empirical knowledge as mirrored in language properly constructed, i.e. constructed by means of meaningful propositions, gave the Vienna Circle a possible tool to interpret Mach's project of the elimination of metaphysics[34]. Lastly, Wittgenstein's idea of the reducibility of facts to elementary statements was evaluated by the Circle as a fruitful alternative for establishing connections between subject (the inquirer) and its object (of inquiry)[35].

It appeared that, notwithstanding the great role of *Tractatus* for the formation of the views in the Vienna Circle, it was a controversial treatise, at least for some members. In addition to the issue of 'elucidatory' nature of its propositions, there were other discussions. For instance, Hahn and Menger could not read and comprehend the text thoroughly [Menger, 1980: xii]. In order to avoid misinterpretations and provide a proper understanding of *Tractatus*, Carnap proposed to read its propositions sentence by sentence at the meetings of the Circle. The members agreed; so the entire academic year of 1926/1927 was spent on this task [Menger, 1980: xii]. However, Menger remained unconvinced of the alleged significance of *Tractatus*; the direction of his interests lied rather in mathematics. Accordingly, in 1928, Menger organized another discussion group, which was named *Mathematical Colloquium* [Stadler, 2001: 204]. Thus, it can be stated that not all of the members of the Schlick Circle were equally interested in dedicating

[33] For details on this aspect, see sub-section 2.4.4.

[34] As implemented in the Vienna Circle's logical analysis of language. See sub-section 2.3.3. for details.

[35] Although the idea of reducibility to the given was not originated in *Tractatus*, since Frege, Whitehead and Russell, or Hilbert specified the procedure of reducibility (translatability); with *Tractatus*, the Vienna Circle was ensured that the appropriate links should be drawn on the plane of language. For details on this issue, see sub-section 2.4.3.

their efforts solely to *Tractatus* and building their philosophical position in accordance with this treatise[36].

In general terms, it can be claimed that towards 1929, the discussions of the Schlick Circle allowed its members to formulate the general lines of their proposal for the elaboration of 'outdated' understanding in the philosophy of science in the light of recent progress in science. Negotiations on the views of Mach, Poincaré and Duhem in the early Circle; discussions of logicism of Frege, Whitehead and Russell, and Hilbert's formalism in addition to the massive effort of the group to grasp Wittgenstein's *Tractatus* – all these were standing as a background for such a proposal. In the light of this background, inspired by the Enlightenment's fight against metaphysics, the Vienna Circle sought for the scientific approach in philosophy, or for empiricist position based on the improvements in science. The 'transcendental' forms and foundations of experience had to be overcome. In connection with this, the Schlick Circle named its approach as "the scientific conception of the world" [Neurath *et al*, 1973: 301], so the eagerness to present it to the world emerged. The task of the next sub-sections is to describe how this approach was formulated officially and was introduced to the public, bringing to the world the (official) Vienna Circle.

2.3.2. *Verein Ernst Mach*

As was described earlier in this chapter, the Enlightenment movement, originated in Europe in the seventeenth century, was settled in Austria by the efforts of the great Austrian thinkers of that time, such as Bolzano, Brentano and, most importantly, Mach. That gave an impulse to retain the progressive tenets of the Enlightenment, and to continue its work towards the popularization of rational, scientific attitude and the liberalization from the burdens of scholasticism and

[36] As it will be uncovered in chapter 3, Neurath, alienated by Wittgenstein's idea of "elucidations", advocated for his own anti-foundationalist approach in the philosophy of science.

religion-based politics. In general terms, the Enlightenment in Vienna reflected the following:

> What all the late Enlightenment currents had in common was a basic humanitarian-cosmopolitan perspective, an uncompromising orientation towards progress and reason and the advocacy of social and cultural reform. In addition, the groups involved worked, both theoretically and in practice, on forming an anti-metaphysical world view and shaping an ethical foundation for everyday life through non-revolutionary strategies that corresponded well to the echoes fundamentally radical-bourgeois in nature [Stadler, 2001: 180].

Among the protagonists of the Enlightenment movement in Vienna was *Freidenkerbund* (the *Freethinker Association*), which aimed mainly at education of the masses in the spirit of the Enlightenment [Uebel, 2014: 9]. Neurath was actively participating in the endeavours of the *Freethinkers*, so when the *Association* proposed to organize a society under the name of Ernst Mach, which would target the "dissemination of scientific ways of thought", and would consequently provide "a forum for popular lectures on the new scientific philosophy" [Uebel, 2014: 9], Neurath realized that the goals of such society would well merge with the approach of the Schlick Circle. Through the society's meetings, lectures and publications, the members of the Circle, in collaboration with the educational goals of the *Freethinkers*, could spread the ideas of the Enlightenment and "a world conception based on the exact sciences" [Stadler, 2001: 331]. In such a way, *Verein Ernst Mach* (*Ernst Mach Society*) was established in Vienna in 1928[37]. Moritz Schlick was selected as the president of the *Society*; the members of the Circle, in addition to the duties assigned to them in the *Society*'s committee, gave a series of public talks and lectures on the developments in science and on the advantages of the "scientific world conception" [Stadler, 2001: 330].

The activities of *Verein Ernst Mach* were important not only because they helped to spread the general approach of the Vienna Circle as the set of new viable

[37] Here one should note that it is mistaken to presuppose that the *Society* was founded by Neurath solely to promote the Vienna Circle's approach. For details, see Stadler, (2001), p. 331.

alternatives in the philosophy of science, but also for the Society's determinant role in the publication of the first official doctrine of the Vienna Circle – *Manifesto*, as the pamphlet was published under the aegis of the Society [Uebel, 2008: 72]. It also was the first step of the Schlick Circle to present publicly the theses and attitudes of their 'new' philosophy, which would further be formulated in *Manifesto*. So what were the theses of *Manifesto* of the Vienna Circle, and how did the document come to life?

2.3.3. *Manifesto* of the Vienna Circle

Wissenschaftliche Weltauffassung: Der Weiner Kreis (*The Scientific Conception of the World: the Vienna Circle*) was published with the help of *Ernst Mach Society* in 1929 as a pamphlet to be distributed at the *First Conference on the Epistemology of the Exact Sciences* held in September 1929 in Prague [Uebel, 2008: 72-3]. Although it was signed by Carnap, Neurath and Hahn as the authors of the pamphlet, it would be more appropriate to state that it was prepared by the joint efforts of Carnap, Neurath and Feigl, with the commentaries of Hahn and Frank [Uebel, 2008: 87]. In fact, the term 'Vienna Circle' was coined by Neurath during the preparation of the booklet, so that the attitudes developed by the members of the Schlick discussion group could have a distinct, memorable name [Stadler, 2001: 28]. In such a way, the Vienna Circle went 'official' – it introduced its new, scientific approach in philosophy, 'totally free' from metaphysics.

Although the "the scientific world conception" was formulated in *Manifesto* of the Vienna Circle for the first time in 1929, the idea that the discussion group around Schlick should have a definite name with the expression of its distinctive, anti-metaphysical attitude was already participated by Carnap and Neurath back in 1928 [Uebel, 2008: 74]. The reason for the publication of the pamphlet in 1929 appeared to be fostered by two factors. Firstly, Schlick's decision to decline the chair position at the University of Bonn and to stay in Vienna in 1929 motivated, so to speak, the members to put efforts in writing the Circle's *Manifesto* in honour of its leader

[Stadler, 2001: 335]. That was why the statement "Dedicated to Moritz Schlick" appeared at the beginning of the booklet [Neurath *et al*, 1973: 299]. Secondly, as the work on *Manifesto* was initiated, there emerged an opportunity to present the document to the public at the *Conference* in Prague in 1929, which was organised as a part of the *Fifth Congress of German Physicists and Mathematicians*, mainly by Philipp Frank's efforts[38] [Uebel, 2008: 73]. By these terms, the year of 1929 was decisive for the members of the Vienna Circle to retain the leader of their discussion group and also to present the Circle's general approach officially.

What were, then, the main aspects of the Vienna Circle's scientific approach, as it was declared in *Manifesto*? In general terms, "the scientific conception of the world" embraced the spirit of the Enlightenment, or the liberation from the fetters of dogmatism in science and philosophy, as it was formulated and cultivated by the theories of many great scientists and philosophers: Ernst Mach, Ludwig Boltzmann and Albert Einstein in physics; Josef Popper-Lynkeus in economy and sociology, Otto Bauer and Max Adler in the theory of Marxism - to name but a few [Neurath *et al*, 1973: 301-4]. In addition, the views of Poincaré and Duhem, the developments in logic and mathematics by Whitehead and Russell, Frege and Hilbert were mentioned among the positions which made a major influence on the formation of the Vienna Circle's conception [Neurath *et al*, 1973: 304]. In this respect, the Vienna Circle's approach aimed at one common goal – the goal of the unified science, or the comprehensive, conceptual unity among all branches of scientific inquiry freed from the complications of metaphysics – "unsolvable riddles" [Neurath *et al*, 1973: 306]. As all empirical knowledge had to be expressed in an appropriate language, this goal, according to the programme of the Circle, was realizable only by the proper logical analysis of language, i.e. the procedure of reduction of any factual statement about the world to the elementary propositions of experience, or the given [Neurath *et al*, 1973: 306]. The method of the logical analysis, as *Manifesto* declared, carried every examination of the validity of facts

[38] Frank was the chair of the department of physics at the University of Prague since 1912.

into the investigation of their meaning. Thus, certain statements, such as 'God exists' or 'There are synthetic a priori truths' failed the procedure of demonstrating their meaning through the process of reduction to the given [Neurath *et al*, 1973: 306-7]. Consequently, all of the statements that claimed a separate existence, i.e. an objective reality of the entities which were not inferable from experience, and by which 'metaphysical philosophy' was filled with, had to be rejected[39]. In such a way,

> We have characterised the scientific world-conception essentially by two features. First it is empiricist and positivist: there is knowledge only from experience, which rests on what is immediately given. This sets the limits for the content of legitimate science. Second, the scientific world-conception is marked by application of a certain method, namely logical analysis. The aim of scientific effort is to reach the goal, unified science, by applying logical analysis to the empirical material [Neurath *et al*, 1973: 309].

Hahn, in his address to the *Conference* in Prague (1929), where the pamphlet was distributed, made another, but also quite accurate formulation of the Vienna Circle's scientific attitude:

> The name 'scientific world view' is intended both as a confession of faith and as a delimitation of a subject:
>
> It is to *confess our faith* in the methods of the exact sciences, especially mathematics and physics, faith in careful logical inference (as opposed to bold flights of ideas, mystical intuition, and emotive comprehension), faith in the patient observation of phenomena, isolated as much as possible, no matter how negligible and insignificant they may appear in themselves (as opposed to the poetic, imaginative attempt to grasp wholes and complexes, as significant and as all-encompassing as possible).
>
> And it is to *delimit our subject* from philosophy in the usual sense: as a theory about the world claiming to stand next to the special sciences as their equal or even above

[39] Here one can question how that propositions of logic and mathematics, not being inferable from experience, but at the same time constituting the structural grounds for the most of scientific theories, are not demarcated as 'metaphysical'. The possible answer to this question lies in the fact that some members of the Vienna Circle agreed with Russell and Wittgenstein, who defined logic and mathematics as 'empty', purely analytic truths, or truths 'by convention'. This definition identified propositions of logic and mathematics as being incorrigibly true by definition. However, such argument might not be convincible; at least it did not convince Neurath, and later Quine, who genuinely criticized it in *Two Dogmas of Empiricism* (1951). This aspect is examined in more detail below, in section 4 of this chapter, as well as in chapters 3 and 4.

> them as their superior. For in our opinion, anything that can be said sensibly at all is a proposition of science, and doing philosophy only means examining critically the propositions of the sciences to see if they are not pseudo-propositions, whether they really have the clarity and significance ascribed to them by the practitioners of the science in question; and it means, further, exposing as pseudo-propositions those propositions that pretend to a different, higher significance than the propositions of the special sciences [Hahn, 1930/1980: 20].

From the words of Hahn it was to be extracted that the Vienna Circle was not rejecting philosophy all along as metaphysical; rather, the members did not believe in the superior nature of philosophy as the ultimate foundation of science. Moreover, the task of philosophy was redirected to the examination of the statements and their proper separation to meaningful/meaningless (pseudo-problems), in accordance with the proceedings of special sciences.

Here, it should be noted that "the scientific conception of world" expressed in *Manifesto* should not be treated as the only ultimate formulation of the Vienna Circle's view. As it will be shown below in the section 2.4., the discussions of the Vienna Circle after *Manifesto*[40] resulted in the divergence of the attitudes towards the matters described in the booklet. For instance, the understanding of 'the given' as the terminating point of reduction and the process of reduction to the elementary experience itself split the members into different camps (or 'wings'). Moreover, the fact that the booklet did not represent all the aspects of discussions within the group was supported by the reaction of the members to the document. Although the pamphlet produced an effect on the public as it intended (i.e. to get people acquainted with the Circle's scientific approach), the reception of *Manifesto* among the members of the Vienna Circle was not always positive [Uebel, 2008: 87]. When Schlick read the booklet, he found its "advertising style" and "seemingly dogmatic formulation" as disturbing [Uebel, 2008: 88]. It appeared that Schlick felt discomfort with pamphlet's call towards collectivisation (of efforts towards the goal of the unified science) and was against any politicizing activities within the Circle

[40] For some of the members – even before *Manifesto*. For details, see sub-section 2.3.1.

and *Verein Ernst Mach* [Uebel, 2008: 88]. In any terms, there were places in the booklet that did not reflect Schlick's view. Menger and Gödel also felt estranged by the pamphlet, as they did not agree that the attitude described in *Manifesto* was common to all members of the Circle [Menger, 1980: xiii]. Therefore, the publication of *Manifesto* could be interpreted as the public announcement of the Vienna Circle's 'innovative' approach to science and philosophy, but only *in general lines*.

At the same time, it should be stated that, notwithstanding the differences in views among the members, they all agreed on the following. Firstly, the belief in the purely scientific method, that knowledge as such was represented only in scientific terms, was supported by all members [Kraft, 1953: 187, 191]. In connection to this, the participants of the Vienna Circle also agreed on the point that metaphysics (propositions, notions, statements, methods and attitudes that could not be comprehended by science in principle) had no place in the proper understanding of scientific activity and in establishing its reliability. In this context, the elimination of metaphysics was a common goal for *all* the members of the Circle.

2.3.4. Remarks on the Public Stage of the Circle: 1929 – 1938

Before passing to the detailed examination of the Vienna Circle's views, several remarks should be made on the public activities of the Circle before its final dissolution in Vienna in 1938. It should be stated that the members of the Vienna Circle contributed a lot to the common cause of promoting its scientific approach. Apart from the lectures and meetings in the scope of *Verein Ernst Mach*, the Vienna Circle's approach was represented in *Erkenntnis*, the journal restarted from *Annalen Der Philosophie* in 1930 and co-edited by Rudolf Carnap and Hans Reichenbach[41]. Plus, between 1928 and 1936, the works of the members of the Circle were

[41] Hans Reichenbach was a German philosopher and protagonist of the 'scientific conception' in Berlin.

published in *Schriften zur wissenschaftlichen Weltauffassung* (*Writings on the Scientific World Conception*), which was edited by Moritz Schlick and Philipp Frank. Lastly, from 1933 to 1939, the series of articles in *Einheitswissenchaft* (*Unified Science*) were published under the editorship of Otto Neurath, reflecting the general approach of the Vienna Circle [Uebel, 2014: 10].

In addition to the publications in journals, a number of conferences and congress meetings were organized within the framework of "the scientific world conception". As the *First Conference on the Epistemology of the Exact Sciences* was organised in Prague in 1929, the *Second Conference* followed in 1930, which took place in Königsberg [Stadler, 2001: 365]. The *Preliminary Conference of the International Congresses for the Unity of Science* was held in Prague in 1934, as the starting session of the *Eighth International Congress of Philosophy*. Subsequently, the six *International Congresses for the Unity of Science* were organised, *First* in Paris in 1935, *Second* in Copenhagen in 1936, *Third* again in Paris in 1936, *Fourth* in Cambridge in 1938, *Fifth* at Harvard University in 1939, and *Sixth* one in Chicago in 1941 [Stadler, 2001: 365-391].

It is remarkable that so much work related to the promotion of the scientific approach of the Vienna Circle was executed, notwithstanding the oppression of liberalism, including anti-Semitic tendencies in Austria in the late 1920s, as the Nazism was accumulating its influence in Europe. The escalation of nationalism and political Catholicism in Austria was not only the starting point for ruining all democratic foundations, but also for the eradication of all academic and educational efforts put in the promotion of the Enlightenment ideas [Stadler, 2001: 508]. After Engelbert Dollfuss came to power in Austria in 1932, parliament was suppressed and the authoritarian regime was pronounced; it became evident that the proper conditions for the maintenance of independent, unprejudiced, rational attitude were lost. In such a way, the major tenets the Vienna Circle was advocating for could no longer survive in Austria, as well as the academic activities of its members [Stadler, 2001: 514]. This resulted in immigration and exile of almost all participants of the

Circle: in 1931, Herbert Feigl immigrated to USA; in 1934, Neurath had to escape to Holland; next year, Carnap moved to USA; in 1937, Menger immigrated to USA, Frank and Gödel followed the same destination in 1938 and 1940 respectively [Uebel, 2014: 8]. *Verein Ernst Mach* was closed in 1934 mainly for political reasons mentioned a few lines above; that year was also unfortunate because Hahn died from the complications of a surgery [Uebel, 2014: 8]. Circa 1934, the major members of the Vienna Circle could not actively participate in the discussions at the University and other public activities, since talks, lectures and official meetings, directed to the promotion of the views advocated by the Circle, were no longer allowed in Austria. With the murder of Schlick by one of his former students in 1936 at the entrance of the University of Vienna, the university meetings of the discussion group were terminated. In accordance with this, it can be claimed that in 1936, the Austrian activities of the Vienna Circle ceased thoroughly, although the members continued their work in immigration. With the annexation of Austria (*Anschluss*) by Nazis in 1938, the way towards "the scientific world conception" was totally intercepted. It was a great disappointment that such an inspirational, promising cause of the Vienna Circle towards science, liberty and freedom of thought from any kind of reactionary (political/religious) inclinations, was drowned in irrationalism and degenerative mentality.

However, even if the scientific approach of the Vienna Circle was no longer maintainable in Austria, it should not be concluded that the tenets of "the scientific world conception" were totally erased or forgotten. As was stated a few lines above, the majority of the members of the Circle continued their work in immigration. That allowed for the promotion and further comprehension of the Vienna Circle's attitude to the academic environments in other countries, such as England and USA. Plus, as was mentioned above, in the years between 1935 and 1941, when the political situation in Austria was deteriorating, the proponents of the Vienna Circle's views managed to organise six congresses for the unity of science in various locations in Europe and USA. By these means, the Vienna Circle succeeded to preserve and deliver its innovative approach to its successors for the further

analysis and complementary work. The next section of this chapter aims to uncover this approach in detail.

2.4. Main Aspects of the Vienna Circle's Approach

As has been mentioned earlier in this chapter, although the general lines of discussions of the Vienna Circle were mutual, there was no strict consensus on their theoretical details. Different members of the Circle had different opinions on how exactly to express and advocate for the "scientific world conception". In such a way, the aim of this section will be to describe the approach of the Vienna Circle mirroring the mutual and discordant points of view among its members, as reflected in certain topics discussed at the meetings, such as verifiability, criterion of meaning and critique of metaphysics, protocol sentences debate and analytic/synthetic distinction. This will allow to uncover the promising, fruitful understanding of the Vienna Circle, the philosophical movement which was till the recent time had only one (standard) interpretation[42].

2.4.1. The Principle of Verifiability

The verifiability principle was one of the central discussion topics in the Vienna Circle [Hanfling, 1981: 4]. Basically, it stated that "the meaning of a proposition is the method of its verification" [Schlick, 1981a: 34]. In other words, propositions, or linguistic formulations of facts about the world, should be expressed, according to the Circle, in a way that their truth/falsity conditions could be fixed. A proposition should have 'sense' in order to be called as such; it should be verifiable by means of experience, or *reducible* to the basic elements of experience.

[42] It was found more appropriate to present the key aspects of this standard interpretation in the last section of this chapter, after exposing the Vienna Circle's approach in detail.

The crucial aspect of the Vienna Circle's understanding of verification was that this procedure should not have been limited only to the cases of actual verification by experience (i.e. only by the direct observation of the phenomenon described in the sentence in question). A statement would still have sense if there was a logical possibility of its verification – if the reduction to the sense-data was possible in principle (if it did not contradict the laws of logic) [Kraft, 1953: 31; Schlick, 1981a: 35]. That was why it was called as the principle of *verifiability*. Three following statements can be taken as demonstrations of this principle. The truth value of the statement 'There is a green car on the other side of the road' (S_1) can be checked by a simple observation of the other side of the road in the specified context. Thus, this statement has sense by the method of actual verification. The meaning of the sentence 'In passing through the tiny slit, the light beam produces the interference pattern on the observation screen' (S_2), which can be taken as the definition of optical diffraction, though not directly demonstrable by the sense-data, can still be established by performing the experiment as described in the statement. Therefore, this sentence is meaningful by the method of possible verification. On the other hand, the value of the statement 'God is omnipresent and omnipotent warrant of truth' (S_3) cannot be possibly fixed by any empirical data report. Consequently, this statement is unverifiable, i.e. is devoid of meaning *in principle*.

In such a way, the principle of verifiability stood, within the Circle, as the main basis for the formation of the epistemic relations and links between subjects and the physical world. For the Vienna Circle, it was a tool to uncover the objective structure of phenomena via language, only by means of which this structure could be expressed. Here, it can be traced that the Vienna Circle's principle of verifiability was generated in accordance with Wittgenstein's understanding of language, which declared the reduction to elementary sense-data reports as the only viable instrument in determining the truth-values of empirical statements. Moreover, the dependence of verification to the process of reduction to basic empirical propositions was mirroring positivism (carried to the Circle by Mach's view) as it incorporated "positivist constructions" [Friedman, 1999: 89].

It should be noted that the tautological nature of logic and mathematics, the aspect in the Vienna Circle's view which was also borrowed from Wittgenstein's *Tractatus*, posed a problem for the principle of verifiability. As logic and mathematics were declared to be tautological, i.e. independent of experience, it had to be concluded that these fields of inquiry were unverifiable, or devoid of sense, which was quite contrary to the scientific approach of the Vienna Circle that put logic and mathematics (as specified by Whitehead and Russell) as the standards of analyticity [Kraft, 1953: 36-7]. Such narrowness of the original definition of verifiability pushed some members (namely, Carnap and Neurath) to reconsider the principle and to infer that the strict bound between verification and meaning should not be necessary, as long as it worked for accomplishing of the empirical testability of factual experience [Kraft, 1953: 40]. This reconsideration of verifiability affected the Circle's conception of meaning, but before mentioning this effect one needs to obtain the Vienna Circle's understanding of 'meaning' itself.

2.4.2. The Criterion of Meaning and Critique of Metaphysics

As described in the previous sub-section, the Vienna Circle closely connected the procedure of verification of propositions with the determination of their meaning. Basically, the Vienna Circle understood the concept of meaning as exposing connections between terms (signs) in a language and objects they signified, being ordered in a proposition, in terms of verifiability principle, i.e. fixing the truth value of that proposition by its translatability (reducibility) to the primitive empirical data, or the given. In other words, according to the Vienna Circle, "a statement has sense …because it can be verified" [Waismann, 1981: 28].

The verifiability criterion of meaning, as mentioned above, allowed the Vienna Circle to realize Mach's plan for the elimination of "trans-empirical" propositions. Since all metaphysical statements (consider, for example, sentence (S_3) above) were lacking any verifiable content, they had to be demarcated as meaningless. The

Vienna Circle identified metaphysics with everything that "transcended" empirical science, with every concept, notion, statement, or attitude with no possible method of verification [Kraft, 1953: 34]. In this respect, the questions of the truly scientific inquiry should be asked accordingly, since "there cannot be questions that are in principle unanswerable since such questions cannot even be meaningfully asked" [Kraft, 1953: 35]. What it meant was that the search for any ultimate, unchangeable philosophical foundations, which would further dictate the ways of how and by what means one acquired knowledge about empirical world, was no longer acceptable. According to the Vienna Circle, objective knowledge was depicted by science, and science consisted only of statements which were in principle verifiable, and no other interpretation was allowed.

It should be noted that it was ordinary (everyday) language in which metaphysical constructions were established. Thus, the Vienna Circle sought for the efficient demarcation tool for 'sifting out' such meaningless linguistic constructions [Hahn, 1980: 29-30]. That was the reason for proposing the logical analysis of language, described in the Circle's *Manifesto*. Such analysis would allow for the proper syntax, or grammatical rules, based on logical inferences, on which the structure (i.e. the relations between terms of language and objects they signified) of verifiable statements could be based. That, in turn, could allow to detect and exclude all meaningless utterances. Carnap worked on such syntax in his *Logical Syntax of Language* (1934).

However, the project of deducing the logical syntax was not successful [Kraft, 1953: 37]. As was mentioned before, the irreducibility of logic and mathematics to the elementary experience pointed to the fact that there were no necessary connections between meaningfulness and verifiability. It was realised that even in scientific propositions, there were *more* in catching and expressing the relations between terms and objects they signified than a mere formal syntactical structure. Thus, the Circle concluded that "the concept of verification cannot be adequately analysed in terms of syntactic concepts alone" [Kraft, 1953: 129]. In such a way,

the original principle of verifiability based on the "strong" criterion of meaning was abandoned. According to Kraft's evaluation, at least Carnap, in his *Testability and Meaning* (1936/37), made such a conclusion [Kraft, 1953: 37].

One last remark: even at the times when the members of the Vienna Circle were still academically active, they realised that scientific claims and conjectures went beyond the given, or at least beyond their syntactical form. One can continue this line of thought and conjecture that theoretical terms, such as 'electro-magnetic wave', 'gravitation', 'natural selection', etc., entail a certain amount of metaphysics[43]. The Vienna Circle's original principle of verifiability failed to capture this aspect of the formulation of scientific propositions[44].

2.4.3. Protocol Sentences Debate: Left vs. Right Wing Division

From the examination performed so far, it can be inferred that the core of the Vienna Circle's attitude revolved around three main aspects in the general aim of the rejection of metaphysical claims: the principle of verifiability, the criterion of meaning based on that principle, and the process of reducibility to the given, which served as a tool for incorporating verification and meaning. Once again, according to the Vienna Circle, a proposition was meaningful, i.e. verifiable, if it was in principle reducible to the elementary experience, or to the given. What should be accepted as 'the given', i.e. *terminus ad quem* of the reduction process, was a topic that produced much debate among the members [Kraft, 1953: 118]. The debate was never settled since the discussion of this issue separated the members of the Circle into two camps: "the radical", anti-foundationalist, or "left" wing, defended by

[43] i.e. certain presuppositions that are helpful in constructing a scientific explanation of a state of affairs but which are not verifiable via reduction to the elementary experience.

[44] In this respect, it can be conjectured that the dominating effect of *Tractatus* suppressed other possible interpretations of verifiability, for instance, the role of conventions in science as it was stressed by Poincaré. If considered, theoretical terms, such as 'electro-magnetic wave' or 'natural selection', could be possibly treated as conventional. This issue will be addressed in the concluding chapter.

Neurath, Carnap and Hahn, and "the moderate", foundationalist, or "right" wing, represented mainly by Schlick and Waismann [Friedman, 1999: 146; Stadler, 2001: 28]. This section will deal with the members' understanding of the process of reducibility to the given by paying attention to the reasons for such a split within the Circle.

The Vienna Circle's conception of reducibility to the given was embraced and developed mainly due to the developments in logic and mathematics at the beginning of the twentieth century, which sought for the logicism and formalism in these branches of science. This formalist approach was delivered to philosophy by the efforts of Wittgenstein, who, as was described above, advocated for the establishment of truth-values of synthetic propositions by means of reduction to elementary propositions [Wittgenstein, 2001: 52]. In the Vienna Circle's terms, the elementary propositions, or the given, were reformulated as the protocol sentences, or basic observational reports [Kraft, 1953: 118]. The discussion on the nature of these reports was the reason that divided the Circle to the wings [Friedman, 1999: 146].

The debate on the nature of the protocol sentences was initiated by the discussion of Schlick's understanding of protocols in the form of *Konstatierungen* (*Affirmations)*, or immediate comprehension of the meaning of an observational statement at the moment of observation [Schlick, 1981b: 190]. If basic observational reports, in Schlick's terms, were written in the form 'Here now such and such', e.g. 'Here now brown table', where the terms 'here', 'now', or 'this' were acting as indicators of the immediately given (as "demonstrative terms"), grasping the meaning of such statements 'coincided', so-to-speak, with their truth value at the moment of observation [Schlick, 1981b: 191, 194]. In other words, they were verified simultaneously with acquiring their meaning, when an image in the mind matched a certain sense-datum. This process of coincidence, or "affirmation", as Schlick presupposed, was quite similar with grasping meaning of analytic statements [Schlick, 1981: 194]. In such way, they could be treated as valid and

unchangeable, and could be further put at the final point of reduction procedure [Schlick, 1981: 196]. In general terms, Schlick's protocol sentences were defined in the framework of (phenomenological) solipsism as the ultimate foundations of all empirical knowledge [Stadler, 2001: 324-7]. This point of view was supported by Waismann [Waismann, 1981: 31-2].

Neurath strongly criticized such understanding of protocol sentences [Neurath, 1934/1983: 102]. First of all, the definition of observational reports as unchangeable foundations of knowledge could not be acceptable since it presupposed a 'foundation', which was, according to Neurath, a metaphysical assertion [Neurath, 1934/1983: 103]. That was contrary to the basic goal of the "scientific world conception". Secondly, the process of 'protocolling' could be hardly performed in such a way (i.e. Schlick's 'affirmations' could not be written in the form of an observational *report*), and as a result, these protocols could not be tested by other observers [Neurath, 1934/1983: 106]. In other words, the validity of the protocols of the form "Here now such and such" could not be established intersubjectively. The feature of intersubjectively testable protocol sentences was also stressed by Carnap [Carnap, 1934/1981: 156]. Contrary to Schlick, Neurath advocated for the protocol sentences in the form of precise observational reports:

> "Otto's protocol at 3:17 o'clock: [Otto's speech-thinking at 3:16 o'clock was: (at 3:15 there was a table in the room perceived by Otto)]" [Neurath, 1932/1983: 93].

The construction of certain observation in accordance with particular space and time linkages could allow, in such a way, for the testability of the protocol by other subjects.

The characteristic of protocol sentences of being intersubjectively testable was crucial for Neurath, since in accordance with his view, protocol statements, although being the final point of the empirical reduction, should not be treated as unchangeable foundations of knowledge [Neurath, 1932/1983: 94]. For Neurath, empirical knowledge consisted in the totality of accepted scientific statements,

some of which were protocol, and some - not [Neurath, 1932/1983: 93]. If the scientific practice necessitated certain change in this totality, then the adjustments were performed, and the protocol statements should not be excluded. Carnap also agreed with Neurath on that aspect [Carnap, 1934/1981: 155].

In such a way, no consensus on the nature of the protocol sentences was achieved among the members. It can be summarized that, for the "left" (anti-foundationalist) wing, reality was defined by the coherent whole of empirical statements, which rested upon the 'in-principle-replaceable' protocols constructed by means of the most basic physical assumptions (space and time linkages) [Neurath, 1934/1983: 102]. On the other hand, the "right" (foundationalist) wing believed that the protocols were the unalterable keystones for the construction of (subjective) reality, which was consisting in the correspondence of propositions to the state of affairs [Schlick, 1981b: 196]. Still, Neurath's understanding of reality convinced the members to conclude that "to be real means empirically: to fit into the spatio-temporal system of the inter-subjectively observable" [Kraft, 1953: 181]. In other words:

> Empirical reality (as distinguished, for example, from illusoriness) means orderability in the space-time physical universe; this is always determinable through a specific means of empirical verification [Blumberg and Feigl, 1931: 295].

2.4.4. Analytic / Synthetic Distinction

The last aspect of the Vienna Circle's approach left to be clarified is the Circle's understanding of analytic and synthetic propositions. After the development of logicism, reinforced by Wittgenstein's argument about the tautological nature of logical propositions, the Vienna Circle concluded that these propositions were purely analytical, or independent of experience [Kraft, 1953: 20]. Mathematics and logic were valid a priori; they had no relation to (empirical) reality, serving as purely conceptual tools in the process of ordering and connecting statements about the world, the process that would result in saying "clearly what is to be said" [Hahn,

1980: 30]. In this respect, Kant's understanding of mathematics as a system of synthetic a priori truths was rejected [Kraft, 1953: 21]. Therefore, according to (some members of) the Vienna Circle, all meaningful propositions were sharply divided into two classes: analytic propositions of logic and mathematics, which were true a priori, and synthetic, or factual propositions about the external world, which were true a posteriori [Blumberg and Feigl, 1931: 282].

It should be stated that the Vienna Circle's unquestionable reliance on the tenets of logicism in proposing the well-defined demarcation between analytic and synthetic propositions was exaggerated. In 1931, Kurt Gödel introduced his Incompleteness theorems, which raised questions about the completeness and consistency of mathematical systems built upon logic [Raatikainen, 2018]. In fact, Gödel's target was Hilbert's formalism in mathematics and geometry, the doctrine which sought for the axiomatization of these branches of science, or for presenting mathematics (geometry) as a complete formal system with logic in its axiomatic basis [Zach, 2016]. To recall the above remark on Hilbert's efforts, Hilbert believed that the new logic, described by Whitehead and Russell, could be sufficient as a logical foundation for the axiomatization of mathematics, which would in turn demonstrate that this field of inquiry was complete (i.e. that every statement in a certain system or its negation was derivable in that system) and consistent (i.e. that there was no statement and it negation existing at the same time in a system). Gödel, in his theorems, showed that such formal system was neither complete, nor consistent. He proved that some statements in a formal system, although derivable from that system, could neither be proved nor disproved in this system (Theorem 1) [Raatikainen, 2018]. To transfer the theorem to the plane of language, Gödel demonstrated that basic statements in a language, notwithstanding the fact that they functioned as foundations for the formulation of new statements, could not be proved as indispensable components of that language[45]. Moreover, Gödel proved

[45] As an example, one may think of Poincaré's conventionalist understanding of the basic theoretical claims in a certain scientific framework – they are neither demonstrable by logic or experience alone,

that consistency of a formal system could not be demonstrated by means of propositions in that system (Theorem 2) [Raatikainen, 2018]. In other words, the formalization of a system did not necessitate its consistency, or eradicating the possibility of arriving at contradictory (negative) instances within that system. In such a way, Gödel showed that the axiomatization of mathematics on the foundations of logic of *Principia* would not result in the complete and consistent system of genuine mathematical propositions. Through Gödel's theorems it was uncovered that, even in the case of mathematics, reducibility to logic was questionable. From that it should be concluded that the Vienna Circle's reliance on logic and mathematics as the source of a priori, incorrigible analytic truths was overestimated.

Although Gödel made his discoveries in 1931, no drastic alteration in the Vienna Circle's belief in the sharp distinction between analytic and synthetic propositions followed. An effort was made by Rudolf Carnap, who tried to incorporate Gödel's theorems in his *Logical Syntax of Language* (1934); still, the analytic nature of logic and mathematics remained unquestionable [Friedman, 1999: 167]. However, it should also be noted that not all of the members of the Circle believed in pure analyticity of mathematical and logical propositions. Neurath, in the defence for his coherence (holist) understanding of science, claimed that neither mathematics, nor logic should be treated as unshakeably reliable [Neurath, 1983: 104]. If, through the course of scientific inquiry, certain modifications or alterations on the level of logic and mathematics would become unescapable, these modifications would have to be made. In fact, Quine, in his *Two Dogmas of Empiricism* (1951), would also draw attention to that point: any approach, which incorporated any components as purely analytic and unchangeable, should be qualified as 'dogmatic'[46]. Consequently, the

however, they function a priori in that framework. Thus, these claims can appear as 'analytic', but not as 'necessary'.

[46] Of course, here one can also consider Quine's earlier attack on the inalterability of logical and mathematical propositions, described in his "Truth by Convention" (1949).

Vienna Circle's distinction of analytic/synthetic propositions was treated as one of pitfalls in its approach.

2.5. The Heritage of the Vienna Circle Reconsidered

The Vienna Circle's general excessive leaning towards the unquestionable analyticity of logic and mathematics, displayed in the sharp distinction of meaningful propositions into synthetic and analytic, plus the mistaken belief that all of the members of the Circle strived solely for replacing Kantian theory of knowledge with the reductionism by means of the logical analysis of language, resulted in quite misleading interpretation of the Vienna Circle's approach among its successors – the only account of the Vienna Circle one had till recent times was framed by this, standard interpretation[47] [Haller, 1985/1991: 96; Friedman, 1999: 2]. However, the materials described in this chapter give an opportunity to demonstrate that the heritage of the Vienna Circle should be reconsidered, since a more detailed examination on the Circle's formation, discussions and activities uncovers that

> The dominant popular picture of the Vienna Circle as a monolithic group of simple-minded verificationists who pursued a blandly reductivist philosophy with foundationalist ambitions is widely off the mark [Uebel, 2014: 66].

As was described in the sections of this chapter, the discussions in the Vienna Circle were always conducted in the critical manner: every topic the members considered,

[47] It should be remarked that the acceptance of such an interpretation of the Vienna Circle's endeavours was, to a certain extent, cultivated by philosophers who either promoted the standard interpretation of the Circle, such as A. J. Ayer in (1959), or by those who criticised the Vienna Circle only within the scope of that interpretation, such as W. v. O. Quine in (1951) or S. Soames in (2003). The aim of such a detailed examination of the Vienna Circle in this chapter is not merely to reinforce a different understanding of the Circle; in principle, every interpretation can be questioned and put into doubt. Rather, the aim here is to underline that a deeper analysis of the Vienna Circle's work allows one to appreciate and accommodate the promising aspects of the "scientific world conception", which are indistinguishable in the standard interpretation. Particularly, this dissertation attempts to show how this promising heritage of the Vienna Circle, as it is expressed through Neurath's approach, can facilitate a competent understanding of scientific activity.

either the analysis of the process of reduction, or the nature of the given, or the conversations on the foundations of scientific knowledge, was comprehended in various ways by different participants. There was no consensus, no unity among the members on the details of the Circle's approach. Thus, it will be more appropriate to claim that the approach of the Vienna Circle, "the scientific conception of the world", integrated different attitudes, or *views* of its members. Instead, what united all the members of the Vienna Circle was their fight against metaphysics. But this fight was not predetermined merely by the Circle's criterion of meaning in its connection to the principle of verifiability. This fight was also aiming at maintaining rational, scientific standpoint, free from the complications of degrading political and religious postulates, independent from any burdens that can be placed upon the continuous formation of that standpoint, as was projected by the Enlightenment movement. The fight against metaphysics was the tool to spread widely "the scientific conception of the world" in *all planes of human life*. When one considers the heritage of the Vienna Circle, this should be taken as the most fundamental promising aspect.

Of course, some characteristics of the Vienna Circle's approach had inconsistencies. The impossibility of reduction of mathematics to logic, as was demonstrated by Gödel's Incompleteness theorems, posed a threat to one of the major claims of the Circle – the verifiability criterion of meaning as the main epistemological instrument to separate genuine statements from senseless metaphysical utterances. In fact, the awareness that mathematics and logic should be treated as the conventional basis of science (rather than its unchangeable, analytic foundations), was uncovered within the discussions of the first Vienna Circle, when the group was examining the views of Poincaré and Duhem. As was mentioned in section 2.2., Neurath foresaw the fruitfulness of that pragmatic understanding of scientific activity, and never gave up advocating for this aspect. As will be demonstrated in the following chapter, this aspect, carried to its successors by Neurath, will aid to uncover how exactly the promising heritage of the Vienna Circle can facilitate an effective understanding of scientific activity.

That, in turn, will allow one to trace that the scientific approach, defended by the members of the Vienna Circle, can be formulated and put forward as a viable contemporary position in the philosophy and methodology of science.

CHAPTER 3

REDISCOVERING OTTO NEURATH'S APPROACH

As was remarked a few lines above, although all the members of the Vienna Circle exhibited the same philosophical attitude in general lines, the more detailed examination of the Circle allowed to uncover the plurality of views among its members. In this respect, the views of Schlick, Frank, and especially Carnap were widely discussed not only during the official stage of the Circle, but also after its dissolution in the 1930s. On the contrary, Neurath's approach remained unnoticed among its contemporaries and successors. Concerning the possible reasons for such a neglect, the literature on the topic provides the fuzziness of Neurath's own formulations and other aspects of his philosophical attitude, such as his criticism of Popper or his *index verborum prohibitorum* [Uebel, 1991: 5]. However, the detailed examination of Neurath's approach by Stadler (2001), Haller (1996), Cartwright *et al* (1996), Uebel (1991, 1992, 1993, 1996) and others allow to overcome such mistreatment of Neurath's position and to re-establish its promising factors. Accordingly, this chapter will deal with the life and work of Otto Neurath, not only as one of the key members of the Vienna Circle, but also as one of the most forward-looking philosophers within and after the dissolution of the Circle. In this respect, the chapter is divided into the following sections. First of all, a small biographical note on Neurath's life will be provided. This may shed a light on Neurath's personality as a thinker. Secondly, the process of formation of Neurath's approach will be described. This task will be accomplished in the context of Neurath's participation in the first Vienna Circle[48], since at that time Neurath became

[48] The early Circle, or discussion group, organized by Philipp Frank in Vienna around 1907, as it was described in chapter 2.

acquainted with the views of Ernst Mach, Henri Poincaré and Pierre Duhem. Thirdly, the keystones of Neurath's approach will be described. In this direction, the uniqueness of Neurath's account will be uncovered through its non-foundationalist, or anti-authoritative character. Moreover, the comprehensiveness of Neurath's approach will be demonstrated by his conception of physicalism and unified science, his understanding of protocol sentences and the process of verification. Finally, the chapter will be concluded by the general discussion of Neurath's legacy, including his role within the Vienna Circle as well as the rediscovery of the promising aspects in Neurath's approach within the scope of interest of this dissertation. In such a way, it will provide the necessary material to carry these aspects to the contemporary philosophy of science, through their assessment with the view of Willard van Orman Quine.

3.1. The Life of Otto Neurath: A Biographical Note

Otto Karl Wilhelm Neurath was born in December 1882 in Vienna. His father Wilhelm was a professor of economics, so Neurath, as he himself described it, "was brought up in a scholarly home" [Neurath, 1973: 4]. In 1902, Neurath began his studies in mathematics at the University of Vienna. However, Neurath's interests soon turned him to the study of economics, history and philosophy, so he moved to Berlin to continue his studies. It should be remarked that during his time in Berlin, Neurath became acquainted with the new logic[49] from Grigorius Itelson, who had a reputation of "an empirical rationalist" and "anti-metaphysician" [Cartwright *et al*, 1996: 75]. Moreover, Neurath learned about Comte's principle of unified science; one may claim that Neurath saw the utility of this principle from the early stage of his academic career. It can be conjectured that it further facilitated his own thesis

[49] By 'new logic' here the works of Frege, or Whitehead and Russell are presupposed.

of the unified science as the tool for the systematization and coordination among sciences[50].

In 1906, Neurath completed his doctorate studies at Friedrich-Wilhelms-Universität in Berlin. By his return to Vienna, Neurath, together with Philipp Frank and Hans Hahn, participated to the early discussion group, or the first Vienna Circle [Frank, 1955a: 1-3]. This important connection was interrupted by the World War I and was resumed only after 1921, during the official stage of the Vienna Circle. As the Dollfuss regime was established in Austria in 1932, there was no longer a possibility to continue any academic activities freely and without consequences. Neurath, as many other members of the Circle, was forced to immigration; he moved to the Hague in 1934 and then to Oxford in 1940. He died in Oxford in December 1945.

Throughout his life Neurath had accomplished an enormous number of tasks, and had great achievements not only as the member of the Vienna Circle, but also as an economist and political activist[51], museologist[52] and sociologist[53]. Such multi-tasking and success in the various activities can be explained by Neurath's energetic and engaging character, his activist attitude in life. Many of Neurath's contemporaries described him as a man with a strong and persuasive personality, a man whose "vitality was irresistible" [Ernst Niekisch, *Daring Life – Contact and Events*; quoting from Neurath, 1973: 28]. Especially, such "vitality" aided Neurath to participate and promote many projects and conferences contributing to the

[50] Neurath's thesis of the unified science possessed the central place in his approach in science – details are provided below in this chapter.

[51] For instance, during his cleric activities during the World War I and afterwards in Munich. For details, see Cartwright *et al* (1996).

[52] Neurath worked on and managed the Museum of the War Economy in Leipzig and the Museum of Economy and Society and Vienna.

[53] Neurath's work on ISOTYPE – pictorial language, for instance, intended for the visualization of different social, statistical, economic and geographic concepts and structures accessible to all.

"scientific world conception" of the Vienna Circle, such as his role in the organisation of *Verein Ernst Mach*, or in writing and publishing the *Manifesto*. Here one may also mention Neurath's active dedication to the conferences for the unity of science, held annually in various locations in Europe and United States from 1934 to 1941 [Stadler, 2001: 363-391]. Thus, it is not surprising that Neurath's son Paul, in writing the memoir of his father, describes Neurath as the "organisational motor" [Paul Neurath, 1996: 24]. With respect to Neurath's efforts within the framework of the Vienna Circle[54], this "motor" constituted for the "driving force" for logical empiricism as a whole [Hegselmann, 1987: xix]. In this respect, Neurath's contribution to the Vienna Circle should not be underestimated. Accordingly, the following sections of this chapter aim for the rediscovery of Neurath's approach, which fuelled the "driving force" of the Vienna Circle.

3.2. The Formation of Neurath's Approach: The First Vienna Circle

In order to grasp the novelty and perspectivity of Neurath's approach, one needs to understand how and under what influences such approach was formulated. There is no doubt that Neurath's view was developed in accordance with his academic studies and interests; however, it can be conjectured that the uniqueness of his approach was sculptured during the meetings of the first Vienna Circle. The task of this section is to explain how the proto-Circle was decisive in shaping Neurath's view.

As "The First Vienna Circle" section in the previous chapter described, the early Circle, which included Frank, Hahn and Neurath as its key participators, worked on alternatives for the re-connection of science, which gained new achievements at the beginning of the twentieth century, with its philosophy, which was undermined by these achievements. In this direction, the group discussed the views of Mach,

[54] Neurath's efforts for the Vienna Circle will be discussed in more detail in the concluding section.

Duhem and Poincaré as the possible paths for the replacement of the outdated, inconsistent philosophies and methodologies. Although the proto-Circle's attempts were not finalized in a well-defined account, they drastically influenced the personal views of the members of the first Circle, especially that of Neurath. The term 'drastically' is appropriate here, since Neurath, who absorbed certain important aspects from the philosophies of Mach, Duhem and Poincaré, formulated his approach accordingly, and stressed this approach throughout his academic career. Neurath did not alter his position and passionately advocated for it during the official stage of the Circle, even when some members began to elaborate their views in accordance with Wittgenstein's *Tractatus*[55]. In such a way, it can be concluded that the uniqueness of Neurath's view came not only from his academic background[56], but from the discussions on Mach, Duhem and Poincaré in the proto-Circle. In which ways, then, was Neurath influenced by the views of these thinkers? A small comparative analysis will serve well to demonstrate the aspects that Neurath carried to his approach from the positions of Mach, Duhem and Poincaré.

Firstly, let one consider the affinities in the views of Mach and Neurath. As was previously underlined, Mach's anti-metaphysical attitude in science had a great influence on all the members of the Vienna Circle[57]. Neurath was not an exception; he mentioned the importance of Mach's anti-metaphysical account on various occasions [Neurath, 1931d/1983; 1932/1983]. Hence, it will be useful to refresh the insights of Mach's view. According to Mach, everything a man can grasp and obtain knowledge for (including space and time), consists of sensations, or their various

[55] Here it is meant the Circle's detailed discussion of Tractatus in 1926-1927, and further 'leaning' towards reductionism through the logical analysis of language. Plus, Carnap's work on the formal syntax may be mentioned.

[56] i.e. not only from his background as an economist and sociologist, due to his studies while in Berlin. For details, see Cartwright *et al* (1996).

[57] In the section 2 of the previous chapter it was remarked that Mach's positivist programme of eliminating all untestable components from science as the main goal of the economy principle and building a more appropriate scientific method based on relations among sensations was influential for the Vienna Circle. Particularly, Mach's criticism of the notions of absolute space and time motivated the discussion among the members [Menger, 1960: xviii].

combinations [Mach, 1890: 49, 61]. In order to support this phenomenalistic assumption, Mach stated that scientific theories were economical tools, or theoretical 'shortcuts' for the representation of the different relations among sensations [Mach, 1983/1960: 586]. In other words, theoretical science served the function of economy for the sake of simplicity in the manifold of sensations. In cases where such economical representation is impossible[58], "science is not concerned" [Mach, 1893/1960: 587].

From Mach one can implicate that most of the statements, notions and concepts, which transcend the sensation-based formulations, are contrary to the economy principle, thus are non-scientific, or metaphysical. Through the course of scientific development, scientific activity became more and more purified from metaphysical assumptions. Science, according to Mach, strived towards unity, or the simplest, the most economical, but at the same time the most comprehensive picture of the world [Mach, 1882/2014: 207]. Thus, from Mach's conception of the unity of science it can be projected that scientific activity is the historically developing process from less economic to the more economic representations, till the total unity is reached (as the ultimate goal). To illustrate this point, Mach incorporates the analogy between physics and a living-organism, that evolves and forms its most efficient structure till it fulfils the adaptation procedure perfectly [Mach, 1883/2014: 233].

Neurath definitely carried this anti-metaphysical characteristic of Mach's view to his own account. Neurath believed that the only effective method of conducting knowledge was by means of experience, and on the grounds of experience[59] [Neurath, 1913b/1996; 1931b/1983]. All "unsolvable riddles" (mainly of scholastic

[58] As, for instance, in the statement 'God is omnipotent', or, 'Sensations possess objective reality'.

[59] All the details about Neurath's approach will be provided in the next section of this chapter. The purpose of this section is to try to understand how the uniqueness of Neurath's view was formed; therefore, in order to avoid unnecessary repetitions, a more general formulation is preferred.

philosophy) must be strictly abandoned as lacking sense, or metaphysical [Neurath *et al*, 1973]. Neurath was quite dedicated to the elimination of meaningless statements from the enterprise of science, for him this procedure was similar to the "fight against a political opponent" [Neurath, 1973: 46]. Moreover, Neurath took from Mach's position the aim towards the unified science, as the only feasible goal of scientific activity, or the goal to "create an atmosphere free of metaphysics" [Neurath, 1931d/1983: 58]. Of course, as was mentioned above, Neurath was acquainted with the idea of the unified science from other sources as well (e.g. from Comte), but it would not be invalid to conjecture that Mach's conception of the unity of science was close to Neurath. This conjecture can be supported by the fact that in his writings, Neurath advocated for the historical process of constant development in science, from one accepted system of facts to another, towards the greater unity (comprehensive totality of scientific statements) [Neurath, 1921/1973; 1935/1983].

Before proceeding, a remark should be made about Mach's influence on Neurath. Although Neurath was in accord with Mach on certain aspects, one should note that their accounts were differing in details. For instance, Mach believed that the starting point of any knowledge claim were sensations; Neurath, on the contrary, would see that point in statements [Neurath, 1931b/1983]. A statement, appropriately formulated in a (physicalist) language was, in Neurath's terms, the bottom line of scientific inquiry, there was no further 'objective reality' or 'ultimate truth'. It is clear that the early-Circle's conclusion about the ineffectiveness of Mach's phenomenalist inclinations had its impact on Neurath.

Apart from Mach's standpoint in science, the discussions of the proto-Circle included the analysis of the views of the two great French thinkers of that time – the views of Henri Poincaré and Pierre Duhem. Neurath carried to his account a number of features from these views, which helped him to formulate his unique approach in the philosophy of science. To consider the legacy of Poincaré's conventionalism in Neurath's account, it can be inferred that Neurath agreed with

Poincaré on the point that decisions (conventions) were inevitable in scientific practice, and that these decisions could not be derived by strictly defined normative procedures[60]. Neurath would treat decisions (agreements), made by scientists, as an underlying aspect navigating scientific activity: for instance, Neurath specified that the process of choosing a certain inductive generalization "cannot be derived logically" and "go back ultimately to the *decisions* of the scientists" [Neurath, 1933/1987: 13]. At the same time, he would reject to treat such decisions as unchangeable foundations of science, or their incorrigibility [Neurath, 1931b/1983]. Rather, for Neurath, agreements among scientists were reached to accomplish a more comprehensive scientific framework, to feed the progress of scientific activity. Neurath would keep this aspect in his approach throughout his career as a philosopher of science.

The influence of another French thinker, Pierre Duhem, can no doubtfully be evaluated as the most recognizable in Neurath's approach. Duhem's first and the most striking impact on Neurath's view can be detected in Neurath's holism:

> Whoever wants to create a world-view or a scientific system must operate with doubtful premises. Each attempt to create a world-picture by starting from a *tabula rasa* and making a series of statements which are recognised as definitively true, is necessarily full of trickeries. The phenomena that we encounter are so much interconnected that they cannot be described by a one-dimensional chain of statements. The correctness of each statement is related to that of all the others. It is absolutely impossible to formulate a single statement about the world without making tacit use at the same time of countless others. Also we cannot express any statement without applying all of our preceding concept formation [Neurath, 1913a/1983: 3].

Neurath was in accord with Duhem on the point that scientific theories should never be treated in isolation, as independent objective 'pieces' of knowledge. Instead, the appropriate understanding of theoretical science should correlate theories as the

[60] It should be noted that the legacy of Mach, Poincare and Duhem are gathered by the author of this dissertation from the analysis of the primary sources (although the secondary literature points out the similar connections). For details on Poincare and Neurath, see Poincaré (1921, especially pp. 79-129), Neurath (1913a; 1932; 1935), and Uebel (1996).

formal interpretations (representations) of experimental laws, arose from certain theoretical background (not out of blue). Thus, if one wants to evaluate a particular part of scientific research, s/he should treat it as a whole, or as a currently accepted unity of theoretical and empirical components. Such unity, or a system of (currently accepted) logically connected propositions for the classification of experimental data is the only 'reality' one can operate with. Accordingly, Duhem's holism presupposed the historical development from less efficient totality of theory and experiment to the more enlightened, more accountable unity in science; Neurath supported that assumption. Shortly, Duhem, as well as Neurath, believed in the continuity, or in 'evolution' of scientific activity[61] [Duhem, 1954: 23, 107, 147; Neurath, 1913a; 1913b; 1921; 1931b; 1932; 1933; 1935]. To demonstrate that aspect of his view, Neurath developed a bright example of a ship, floating at the sea without an opportunity to moor at a port. The explicatory characteristic of this metaphor will be described in more detail in the following pages.

Apart from Duhem's holism, Neurath was influenced by Duhem's understanding of "good sense", or non-rational motives and intuitions of a scientist to make a decision and choose a certain hypothesis or theoretical representation in the process of his/her work [Duhem, 1954: 217]. Neurath would call such intuitions as "auxiliary motives", or scientist's intuitive drives for action [Neurath, 1913a]. Although not complying to any formal laws (of logic, for example), he believed that these drives played a vital role in the development of science.

Generally speaking, Neurath gained a number of promising characteristics for the formulation of his own attitude towards science. Anti-metaphysical, positivist approach of Mach plus his belief in the unity of science, Poincaré's conventionalism and Duhem's holism – all these appear as features of a far-reaching theory in the

[61] It is remarkable how Mach, Poincare and Duhem all describe science as an 'evolving' activity [Mach, 1883/2014: 233; Poincare, 1921: 91; Duhem, 1954: 252, 256-7]. It can be conjectured that Neurath's vision of science as an ever-developing discourse, or, in other words, as a historical process, was most likely carried from these thinkers.

philosophy of science. Accordingly, the task of the next section is to analyse how these features helped Neurath to formulate his unique, distinct approach.

3.3. The Uniqueness of Neurath's Approach

As was mentioned above, Neurath, navigated by his academic interests, studied history, economics and sociology. Adding to this the influence Neurath extracted from the discussions of the first Vienna Circle, his view was formulated in the specific manner, which stood, most of the time, independently from all other members of the later, official Circle. Accordingly, this section will uncover the key aspects of Neurath's unique account. This, subsequently, will allow to examine whether such unique position can facilitate the present-day understanding of scientific activity.

3.3.1. Non-foundationalism and the Fight Against Metaphysics

It will be more appropriate to start the detailed description of Neurath's account from his non-foundationalist attitude, since Neurath's non-foundationalism accommodates and connects all other features of his approach. Particularly, Neurath's anti-foundationalist attitude mirrors his fight against metaphysical formulations. How, then, was Neurath's denial of any foundations in science expressed?

In the spirit of Mach's anti-metaphysical stance, Neurath conceived that the developmental character of scientific activity, vindicated by the achievements in science at the beginning of the twentieth century, could not be represented by methods with unchangeable and static constituents. All philosophical notions, concepts and attitudes, declaring their reign over science, or dictating the 'absolute' norms and rules which science should strictly follow, appeared, in the light of the scientific progress, as untenable and inappropriate. Navigated by the discussions

within the proto-Circle, Neurath concluded that accepting any kind of unalterable elements in the foundations of a theory was contrary to, or was against actual processes in scientific activity. Claiming that certain notions in a hypothesis were incorrigible meant that these components had a privileged, 'absolute' value; that would be undermined as soon as science will take its further step and demonstrate that, in the light of empirical progress, a more comprehensive, more efficient theoretical framework could be established. That, for Neurath, could be avoided only by a more flexible account of scientific activity:

> We are never in the position to place certain indisputable sentences at the very top and then clearly and accurately display the whole chain of ideas, be it in logic or in physics, in biology or in philosophy. That which is unsatisfactory seeps through the whole of the realm of ideas, it is detectable in the first premises as in the later ones. It is of no use to be careful and supposedly renounce knowledge already gained in order to proceed from a *tabula rasa* and improve things henceforth... Such attempts only end with rough masquerades of insight which tend to be worse than all that preceded them. We cannot but declare truthfully that the current state of knowledge has been presupposed and that we shall try to improve matters by making changes here and there [Neurath, 1913b/1996: 130].

For the purpose of flexibility in his account, Neurath incorporated Duhem's understanding of science: the currently accepted set of scientific beliefs in the form of logically constructed statements, navigated by experimental data, formed a scientific whole, in which scientists operated and worked with. In other words, science, according to Neurath, consisted of the coherent whole of statements, some of which served as abstracted laws, others represented auxiliary assumptions and hypotheses, still others expressed empirical data in the form of basic observational reports. When a new statement was formulated by scientists, it should be formulated in accordance with that coherent whole; if this new candidate clashed with the value of the existing totality, it was either rejected or the components of the totality were reconsidered [Neurath, 1913a/1983: 3; 1930/1983: 42]. However, no component was immune to rejection by empirical data – eventually, in the process of scientific development, once accepted totality of statements was transformed to a new scientific whole. Shortly, it can be concluded that for Neurath, investigations in the nature and the value of scientific inquiry lied on the plane of statements: the

coherent harmony among accepted sentences was sufficient enough to represent scientific viability. Any further presupposition of 'truth', 'reality' or 'objectivity' was, according to Neurath, metaphysical (foundational).

In such a way, it can be inferred that Neurath's approach incorporated pluralistic and pragmatic features. If one extracts from Mach's position that every element in a scientific theory served the function of economy, and from Duhem's - that every observational fact could be expressed in a variety of theoretical representations, s/he can conceive how, for Neurath, the work of a scientist on a certain phenomenon in the existing totality of statements directed him/her for the achievement of the greater harmony and efficiency. Still, for Neurath (as for Mach and for Duhem) there were no predetermined paths and cast-ironed methods that could be dictated from above to be strictly followed in the achieving positive results. Every inquiry could be performed *in the variety of ways*. The only 'determinate' factor in the course of scientific practice was experience, as interpret by scientist in the statements representing observational data. Adding to this Neurath's competence in history and sociology, he claimed that scientific activity should be seen as the process of historical discourse, where all members of a community had a chance for active participation [Neurath, 1913a/1983: 10]. In this respect, scientific practice, for Neurath, was constituted by the collective contributions of society, it was a social activity [Neurath: 1933/1987: 22-3]. That was why Neurath stressed that all scientific formulations should be expressed in a language – science was pictured by him in the form of the totality of statements in order to be accessible for all members of society for comprehension and evaluation.

Neurath developed a brilliant metaphor in order to illustrate his (holist) approach – he compared the process of scientific activity with the ship, constantly floating at the sea without an opportunity to find a dry dock. For the purposes of brevity, this visualization is sometimes called as 'the boat' metaphor, or the "Neurath's Boat"[62].

[62] Such formulation is used in Cartwright *et al* (1996).

Although generally Neurath's account suffered from unpopularity among its successors, the boat metaphor was more frequently referred to in the works of other thinkers[63]. Neurath incorporated this illustration on the various occasions[64]; it can be presented as follows:

> We are like sailors who on the open sea must reconstruct their ship but are never able to start afresh from the bottom. Where a beam is taken away a new one must at once be put there, and for this the rest of the ship is used as support. In this way, by using the old beams and driftwood, the ship can be shaped entirely anew, but only by gradual reconstruction [Neurath, 1921/1973: 199].

It is more or less apparent that the 'ship', which is forced to the open waters and thus repairing itself to stay afloat, represents the totality of accepted scientific statements (or scientific activity as a whole). But Neurath's visualization is much more absorbing than it appears at the first sight. Firstly, it underlies Neurath's point of the absence of any strictly defined boundaries and foundations of scientific activity[65]. If one looks at the actual scientific practice, s/he will realise that each particular case has its own special tools for achieving successful results, motivated by the predictive power of a theory (its verifiable content). Every scientist aims at the greater value (greater predictive success) and at the greater efficiency of his/her theory (greater applicability and comprehensiveness). However, no one is truly independent in that pursuit. Every assumption, every experiment, every theoretical abstraction is bound to the scope and framework of scientific background, availability and precision of measuring tools, political, social and other factors that can impact and direct the inquiry in a certain way. Among the multitude of possible alternatives, scientific activity takes its best bets. Thus, the establishment of any

[63] See, for example, Quine (1969a; 1969b).

[64] It appeared in Neurath's writings at least three times, in (1913b/1996), (1921/1973) and (1932/1983).

[65] At the first glance, it can be assumed that Neurath's 'boat' metaphor gained popularity among successor thinkers simply because it was handy for the visualisation of any holist or pluralist philosophy. However, this metaphor is essential for an appropriate understanding of Neurath's account as it underlies his non-foundationalism *in the first place*, which in turn incorporates holist, conventionalist, and other aspects.

concrete set of methodological norms will never be sufficient to evaluate *every* case in science. One can agree with Neurath in the respect that science is a practical affair, so the evaluative tools should be as adaptive as possible to understand this process properly. Secondly, the metaphor helps to expose Neurath's belief in the continuity in science. If one accepts progress in science, as reflected in its accomplishments, then, in accordance with Neurath's approach, this progress should occur successively, from statement to statement. Science 'evolves', expands its scope through the gradual transformation, not in the manner of discrete, totally unrelated 'blocks' of research. Just as the 'ship' is reconstructed at the open sea, so is the scientific activity, through the elaboration and reconsideration of the accepted beliefs. Thus, the postulation of unalterable foundations in order to guarantee the 'truth' or reliability of scientific knowledge is, following Neurath's position, irrelevant. By the same token, the possibility of anchoring into the complete system of knowledge, certain 'objective reality' is also hardly achievable. And lastly, the boat metaphor demonstrates the role of throughout participation of society in the process of scientific activity. Neurath compares members of society with "sailors", who take the steering wheel and navigate the inquiry in the most efficient way they can in order to stay afloat. In this respect, actions and efforts of men are determinate in shaping the course of scientific development.

Taking all this into consideration, one can ask: how do scientists navigate their inquiries, are there any tools for 'steering the wheel'? If Neurath's pluralistic claims are accepted without any systematising support, it will be hard to demonstrate the reliability of scientific knowledge in principle; the suspicions of subjectivism and relativism inevitably come to mind. At this point Poincaré's influence on Neurath comes to surface: Neurath claimed that although no universally valid tools were available in scientific activity, the conventions achieved by scientists could be taken as the 'warrants' of objectivity, in Neurath's sense of the word[66] [Neurath,

[66] i.e. without presupposing that certain components of a scientific framework correspond to the ultimate nature of the world.

1933/1987: 13]. In this respect, Neurath's view appears to resemble to that of Poincaré – scientists, through the course of inquiry, have to agree on accepting certain assumptions and hypotheses as if they are valid independently, in order to make accomplishments (theoretical and empirical) in that field of inquiry. In such a way, the process of scientific activity is navigated and the reliability of scientific claims can be established[67]. And although the validity of conventions cannot be demonstrated a priori, they are not arbitrary. In most of the cases, scientists are motivated in their decision-making process by their interest in achieving greater simplicity, or greater efficacy, or greater functional value, or the greater unity among statements that will be established by accepting a certain convention. In such a way the necessity to proclaim one theory as 'false' and another theory as 'true' disappears – it is enough to conclude that making an agreement on a certain assumption gives a way to a more consistent, more unified system of facts[68]. Neurath identified the decision-making process with "auxiliary motives", or scientists' intuitive urge for action to eliminate uncertainty and hesitation [Neurath, 1913a: 4; 10]. In any case, 'steering the wheel' does not occur in the blind and random manner, the decisions of scientists to accomplish a concrete path are most of the time motivated for the theoretical and predictive success, mirrored in the verifiable content of a chosen theory.

With all this in mind, one can conceive Neurath's approach as acceptable among the candidates for the evaluation of the process of scientific activity. Still, one can

[67] Uebel (1996a) states that for Neurath,

> if there is anything that can have something like a "theory of knowledge", but without correspondentist anchors in reality, and can generate normativity, then it is conventions. Conventions do not weaken objectivity, they make it possible in the first place [p. 107].

[68] Here it is not presupposed that the process of conventional agreement is conducted promptly and unquestionably. Most of the time, it is challenging and time consuming for a scientific community to reconsider the accepted beliefs or make a preference towards more contemporary assumptions and hypotheses. For instance, it took more than two centuries for physicists to abandon the corpuscular theory of light and accept its electro-magnetic wave alternative. Still, within the process of scientific discourse, certain preferences, or conventions, dominate for the sake of predictive success.

react to Neurath's considerations and assert that without any relations to objective reality, Neurath's coherent totality of statements cannot represent a truly scientific account. Either certain norms should be presupposed with the price of sacrificing the strict anti-foundationalist attitude, or claim that every venture in science is random and instrumental to the needs and interests of scientists. In order to avoid both sides of this critical line of thought, Neurath introduced his thesis of physicalism, as the tool towards the unified science. Accordingly, the next sub-section will deal with the detailed discussion of Neurath's physicalism.

3.3.2. Physicalism and the Unity of Science

As was demonstrated above, Neurath was sceptical about any incorrigible constituents in scientific activity. For him, that was the essence to be embraced from Mach and the movement of Enlightenment. Still, it should not be concluded that Neurath treated rationality as a dull and unnecessary characteristic of scientific enterprise. On the contrary, he truly believed in the power of science as the only tool for achieving prosperous and productive way of living[69]. Thus, it will be more appropriate to qualify Neurath's approach with the conception of adaptive, or, as Thomas Uebel defines it in his *Otto Neurath and Neurath Reception: Puzzle and Promise*, "controllable" rationality [Uebel, 1991: 9]. It is crucial to take this aspect on account when analysing Neurath's position.

In accordance with such conception of rationality in science, Neurath provided his account of scientific inquiry and his understanding of the aim in science – the thesis of physicalism. Basically, by physicalism Neurath meant that all statements in empirical science should be written in accordance with the spatio-temporal relations [Neurath, 1931a/1983: 49]. The unity of structural (spatio-temporal) connections between scientific laws (theories, hypotheses, definitions, etc.) and observational

[69] Here one can recall the main tenets of *Manifesto* of the Vienna Circle, which advocated for the "scientific world conception". It was eagerly and repeatedly stressed in Neurath's own writings – see, for example, [Neurath 1930/1983; 1931a/1983].

terms thus formed the coherent harmony of statements, or the whole of scientific 'knowledge'. This constituted the unity of science, which, for Neurath, was "the strictest scientific principle" [Neurath, 1932/1983: 92].

The 'medium' for expressing the connections between theory and experiment in the framework of physicalism was language, according to Neurath:

> Language is essential for science; within language all transformations of science take place, not by confrontation of language with a 'world', a totality of 'things' whose variety language is supposed to reflect. An attempt like that would be metaphysics. …It is impossible to turn back behind or before language. […] Thinking in terms of language as physical process is the starting point of all science [Neurath, 1931b/1983: 54].

Language, as specified in the quote, was seen by Neurath as a defining aspect of scientific activity – it was an intersubjective (social) tool for the expression, construction, communication, spreading of scientific statements and putting them under the test by experience (i.e. verifying/rejecting process). However, it was meaningless for Neurath to conduct any further speculations, such that the terms, referred to substantial characteristics of objects, signified their true 'nature'. What was once presupposed as the definition of 'light', 'space', 'number', etc., changed its meaning in accordance with the achievements in science[70]. Stating otherwise would lead to foundationalism, which was contrary to Neurath's approach in principle. In such a way, it can be implied that language is a social affair, the content of which is framed by the currently accepted totality of scientific statements. Moreover, if language, as the ground level of all scientific inquiry, is constructed socially, education gains importance, since the proper selection of characteristics and the scope of vocabulary that gets passed through the process of education can facilitate a more qualified and competent process of scientific research. On the

[70] In other words, the same *definiendum* may correspond to different *definiens*, in accordance with the meaning articulated by current scientific framework. Although terms of ordinary language face such 'shifts in meaning' on a rarer occasion, theoretical terms in science do change in meaning. Here one may also recall Poincare's conventions, or agreements to use some terms as definitions, as if corresponding to reality, in order to proceed successfully in the inquiry in question.

contrary, overload of metaphysical (i.e. unverifiable in principle, dogmatic) terms underrates the primacy of science with all its efforts for the better living and better society.

The contribution of education for the "scientific conception of the world' was vital for Neurath, since for him education did not mean mere introduction of scientific developments to the masses:

> Educational work for him [Neurath] meant a comprehensive enlightenment, meant the creation of those intellectual tools which could contribute to the betterment of their life conditions [Dvorak, 1991: 268].

For these purposes, Neurath (together with other members, such as Edgar Zilsel, Viktor Kraft, Friedrich Waismann) taught at the Viennese institutes of adult education – *Volkshochschulen* [Dvorak, 1991: 268]. In addition, Neurath's work on pictorial statistics at the Social and Economic Museum in Vienna intended for the visualised introduction of social-economic relations to the masses. In this context, the terms 'unity' and 'intersubjectivity' gain a deeper meaning in Neurath's approach – science was to be constructed from publicly accessible (thus shareable) and intersubjectively testable (thus discussable) totality of statements. Moreover, in such a way one can more easily conceive how, in Neurath's understanding, science is constructed by the common efforts of the society. In this context, the following words of Victor Adler will perfectly characterise Neurath's attitude towards education as an effective mean for spreading his approach:

> To think about what you have become and what you should become, that I call education. And you reach a still higher level of education, if knowledge has awakened the will – if it emerges as your conscious goal, from your awareness of being products of society, that you are to become its masters, creators and stewards [Adler, 1902. Quoted from Dvorak, 1991: 268].

Before proceeding, another remark about Neurath's understanding of language should be made. After the detailed reading of *Tractatus*, the Vienna Circle dedicated its efforts to the logical analysis of language, or to the formulation of the

formal, thoroughly applicable logical syntax that would guarantee the unquestionable demarcation of meaningful statements to be accepted as scientific[71]. Neurath, with his anti-foundationalist understanding of language, could not agree with introducing logic as an unalterable directive for the formulation of scientific language. For him, scientific language resembled a "jargon", which correlated the terms of ordinary language and scientific terms [Neurath, 1932/1982: 92]. The imprecise terms (*Ballungen* – "agglomerations") were always incorporated in the practice of science; there was no possibility to apply a set of definite rules for the scientific language, as it evolved and transformed for the greater unified whole [Neurath, 1932/1983: 92; 1933/1987: 3]. Here one can pinpoint another plane of Neurath's holism[72].

In general terms, Neurath defined physicalism in terms of the unified science, or the unified whole of statements, some of which were theoretical abstractions and others – empirical data reports. This whole was expressed by means of the physicalist language which, although not strictly normative and undergoing transformations together with the developments in science, connected theory and observation by means of spatio-temporal connections. The aim of such a totality was to make predictions, and thus, by establishing a greater amount of verified content, proceeding through the process of scientific inquiry:

> The unified science as physicalism, which is characteristic of a definite historical period, avoids all meaningless sentences and proceeds from statement to statement; these are combined in a consistent system as tools for successful prediction, that is for life [Neurath, 1931d/1983: 61-2].

The concept of unity had also another meaning in Neurath's theory – through his writings he was expressing that the common goal for the philosophers of science

[71] Especially, such work was conducted by Carnap in *Logische Syntax der Sprache* (1934) – *The Logical Syntax of Language* (1937).

[72] One may have noticed that Neurath's holism does not completely link up with his anti-metaphysical attitude. This issue will be addressed in detail in the final section of this chapter.

was to establish cross-connections among different sciences and to construct the Encyclopaedia of the unified science[73] [Neurath, 1935/1983: 115]. Such encyclopaedia would not only represent scientific accomplishments, but also demonstrate that different branches of science could be arranged and grasped without the postulation of any unalterable principles and notions. Neurath dedicated his efforts to initiate and promote the work on the construction of the Encyclopaedia; however, with the outbreak of World War II only two volumes of it was completed.

3.3.3. Protocol Sentences and Verification

As one can recall from the chapter 2, the general approach of the Vienna Circle defined the reliability (meaningfulness) of scientific claims with the process of reduction to the given, or to the basic observational reports – protocol sentences. In such a way, if the reduction was successfully validated by the positive observational report, a claim was verified by experience, and thus accepted as scientific. However, the details of the process of reduction was highly discussed among the members of the Circle, resulting in the division of the views, with Neurath and Schlick on the opposite sides of the argument. Schlick advocated for the correspondence theory of meaning, which treated protocols as 'affirmations' in the form of 'Green car here now'. Neurath, on the other hand, rejected such understanding and stated that protocols should be expressed in the form

> Yevgeniya's protocol at 19:50 o'clock: [Yevgeniya's speech-thinking at 19:49 o'clock was: (at 19:48 o'clock there was a green car on the other side of the road perceived by Yevgeniya)] [Neurath, 1932/1983: 93, edited].

In such a format, Neurath claimed, protocol statements would take the form of legible, intersubjectively checkable observational reports. Only in this format they

[73] Haller (1991a) states that Neurath's promotion of the unified science within the Vienna Circle was conducted in order to broaden "Descartes-Leibniz program of *scientia universalis*" [p. 29].

could be incorporated as verifying (falsifying) instances within the process of testing theoretical statements. How did Neurath define protocol statements and the process of verification within the framework of physicalism?

To repeat once again, for Neurath science represented the coherent whole of currently accepted scientific statements. The aim of this unity was to produce successful predictions; to serve this aim, protocol sentences were introduced as the basis for checking in the process of verification [Neurath, 1931b/1983: 53]. To increase the value of protocols, Neurath stressed that they should be written in the form provided above, i.e. containing space-time relations, so that other subjects could perform the verification procedure. In other words, protocol statements should be expressed in the physicalist language. Moreover, protocols, as the parts of the existing totality of statements, were at no point incorrigible:

> There is no way to establish fully secured, neat protocol statements as starting points of the sciences. There is no *tabula rasa.* …Statements that were used at a certain age drop out at a later age and are often replaced by other statements. Sometimes the wording remains, but the definitions are changed. *Each law and each physicalist statement of unified science or of one of its factual sciences is subject to such change. The same is true for each protocol statement* [Neurath, 1932/1983: 92, 94].

It can be inferred that Neurath advocated for such specific kind of protocol sentences for the particular reasons. First and foremost, his non-foundationalist approach necessitated the absence of irrefutable certainties and truths. Thus, providing protocol statements with the status of unchangeable foundations of knowledge would clash with the basic features of Neurath's approach. Secondly, Neurath reacted to any conception of meaning that could lead to metaphysical assumptions of "truth" and "reality"[74] [Neurath, 1931b/1983: 53]. The totality of statements expressed in the physicalist language was all one could conceive and analyse in science; presupposing that a protocol statement could correspond to the

[74] Such as Schlick's phenomenalist theory of affirmations or Carnap's constitution theory.

objective reality simply by means of a linguistic report of direct sensation or by some other purely subjective means was not acceptable for Neurath.

Neurath's view of verification should also be understood differently, not as it was defined by Schlick, Waismann or Feigl. To recover once again, the moderate wing of the Vienna Circle represented by these thinkers advocated that "the meaning of a proposition is the method of its verification"[75] [Schlick, 1981a: 34]. In other words, Schlick and others in his camp presupposed that in order for a statement to be meaningful, or verifiable, it should correspond to certain state of affairs (to a certain observational basis, a protocol in the form of 'affirmation'). In this respect, protocol statements stood as the warrants of objectivity, the foundations of meaningfulness, thus underlying for the verification procedure in particular and for the positive value of science in general.

Neurath was alienated by such standpoint:

> … If a genuine sentence contradicts accepted genuine sentences and is sacrificed, we call it "false"; to ask for a further "criterion of truth" makes no sense. There is no court of appeal outside the totality of sentences. We do not therefore speak of "verification by means of the given" [Neurath, 1933/1987: 6].

In these terms, Neurath's understanding of verification can be formulated as the (intersubjective) test of a proposition on its (dis)/agreement with the existing totality of statements. There are no strict rules, no 'principles' and 'methods', following which will guarantee verification of a statement. Protocol statements may stand at the bottom of scientific inquiry; formulating them in accordance with spatio-temporal relations is enough for the establishment of necessary checking conditions on empirical level. However, if one accepts Neurath's approach in science, s/he should be cautious not to fall into the realm of foundational assumptions about

[75] As it was remarked in the second chapter, the Vienna Circle's moderate wing was in alliance with Wittgenstein in that respect.

objective reality, when so much effort is put to separate all unverifiable assumptions from science within the scope of "scientific world conception".

It should be remarked that Neurath was not alone in attacking Schlick's definition of protocols and principle of verification. Carnap supported Neurath in his attitude towards basic observational reports. In his *Protocol Statements and the Formal Mode of Speech* (1934), Carnap claimed that the necessity connection between meaning of a term and its correspondence to the definite state of affairs should not be asserted [Carnap, 1934/1981: 150]. He stated that in order to grasp meaning of a term or a proposition, it was enough to be acquainted with grammar and vocabulary of the language this term or proposition was used in. Moreover, Carnap agreed with Neurath in claiming that protocol statements, as the basis for verification of scientific claims, should be expressed by specifying spatio-temporal conditions, in order to make them testable intersubjectively. Lastly, Carnap supported Neurath in his idea of non-foundational nature of protocol statements, by signifying that the ability to construct a protocol as a basic observational report required the conventional presupposition of certain scientific laws and principles[76]. Thus, even at the level of protocol statements, one can never unquestionably state that a certain observational report corresponds to the objective reality, since the procedure of 'reporting' is conditioned by certain conventional assumptions.

In such terms, Neurath advocated for his own understanding of the process of verification, based on the reliance to protocol statements. It can be concluded that Neurath's 'procedural' attitude towards scientific activity, and his non-foundationalist position was implemented in this aspect of his approach as well. It can be conjectured that the uniqueness of Neurath's account revolves around these factors. Accordingly, the task of the last section in this chapter is to analyse the role of Neurath's work within the Vienna Circle, and formulate the heritage of his

[76] For example, certain (conventional) definition of space and time.

approach in attempt to construct a contemporary understanding of scientific activity..

3.4. The Legacy of Neurath's Approach

At the beginning of this chapter, it was stated that, notwithstanding Neurath's active participation in the Vienna Circle, his approach was to the vast extend neglected comparing to the views of other, more 'popular' members. However, the examination conducted in this chapter demonstrates that Neurath's position should not be neglected simply by inferring that the fuzziness of Neurath's formulations did not allow to appreciate his account. On the contrary, this chapter attempted to indicate how Neurath succeeded to advocate for a distinctive and competitive scientific approach in philosophy. Thus, in the concluding pages of this chapter, the significance of Neurath's work will be discussed, exposed firstly through his efforts within the Vienna Circle, and then independently as an influential thinker of the twentieth century.

3.4.1. Work within the Vienna Circle

Neurath's contribution to the Vienna Circle was remarkable. First of all, his organisational efforts should be considered. As was mentioned earlier, Neurath participated actively in the establishment and operation of *Verein Ernst Mach* – educational platform where many members of the Circle conducted lectures, seminars and talks to spread the "scientific world conception" [Stadler, 2001: 331]. Moreover, his work on *Manifesto* should be taken on account. The publication of this pamphlet in 1929 was crucial, since it represented the main tenets of the Vienna Circle. *Manifesto*, written by the joint efforts of Neurath, Carnap and Feigl, introduced the distinct, anti-metaphysical position of the Vienna Circle to the public. Plus, the term 'Vienna Circle' was developed by Neurath, so that Schlick's discussion group and its strictly scientific attitude could be recognised widely. In

addition to all these, Neurath demonstrated his organisational skills while working on the conferences for the unity of science, held annually from 1935 to 1941, in order to provide necessary environment for people to share and promote the tenets of the Vienna Circle [Stadler, 2001: 363-391]. All these efforts were propagandic in character; Neurath's motivation to spread the enlightened conception of the Vienna Circle lied rather in his conviction that a well-articulated scientific position, without complications of metaphysical (unverifiable) notions and principles, could be constructed and cherished only collectively, by all members of society. Thus, sharing of the Vienna Circle's approaches and methods with wide public through talks, lectures and conferences was crucial. For Neurath, "The Scientific Conception of the World", as it was formulated in *Manifesto*, could not be forced or dictated by authorities, academics, gods, etc., it was built through and by the active contributions of society:

> It is of decisive importance for the scientific world-conception to become aware of the narrowness and limitation of knowledge …because otherwise there would be the danger that one creates a new idol by the postulate of complete definiteness, one that would take the place of the old a *priori,* or the infinite and the divinity. Where formerly the priest or philosopher stood, the professor would stand. We must refrain from such hasty postulates. […] Our thinking is a tool, it depends on social and historical conditions. One should never forget this [Neurath, 1930/1983: 45-6].

It should be remarked that, apart from all organisational activities within the Vienna Circle, Neurath formulated his approach in science in the manner closest to the Circle's anti-metaphysical attitude. Neurath's stressing for non-foundationalism, which he preserved notwithstanding the fact that majority of the members' views had their sympathies and inclinations towards fixed, unshakeable foundations of knowledge, resulted in a more sensitive, more rigorous position with respect to taking on account metaphysical assumptions. In Neurath's writings, no textual evidence can be found on his strict classification of all propositions to analytic/synthetic, or on his pronouncement of certain statements as unalterable, or on the fact that he defined the procedure of reduction to the given as the only way of establishing reliability in empirical knowledge. On the contrary, for Neurath, every component and aspect in science was open to discussion. Neurath advocated

for non-foundationalism since it allowed for a more flexible, more adaptive analysis of actual scientific practice, and embraced the multiplicity of ways and methods incorporated in scientific activity. From this perspective, it can be inferred that although Neurath's approach was not much appreciated among its contemporaries, it actually contained certain promising aspects which, if comprehended, could be taken on account as the basis of an effective philosophical standpoint. In fact, it can be conjectured that the right wing's[77] leaning towards foundationalism and its unquestionable acceptance of *Tractatus*, which lead to an inconsistent connection between meaning and verification was, to a certain extent, responsible for the further representation of the Vienna Circle in the form of standard interpretation[78]. Consequently, other features the Circle introduced in the "scientific world conception", particularly its anti-metaphysical, or anti-authoritative stance, remained unacknowledged. Only a detailed examination of the movement could bring this aspect back to light again.

3.4.2. Neurath's Approach Reconsidered

If one wants to attain a very general formulation of Neurath's approach, s/he can state that for Neurath, science is a gradually developing process of inquiry from one totality of statements to another, expressed in physicalist terms. However, this formulation will remain incomplete, since it does not embrace the aspects that bear the potential of Neurath's approach. This potential includes the following factors. First of all, Neurath's fight against metaphysics, rendered through his non-foundationalist and pluralist understanding of scientific activity should be treated as a promising aspect, since it suffices well the actual scientific practice. Neurath's approach does not stand as a rigid, or restrained systematization of scientific inquiry; rather, it agitates to accept the process of scientific activity as primary to

[77] "Moderate" wing of the Vienna Circle, represented by Schlick, Waismann and Feigl.

[78] Here it is not implied that only Neurath's approach was important in the Vienna Circle. Rather, it is underlined that Neurath's account was as important, as competent as other views articulated within the Circle.

any methods and fundamental principles. The postulation of any normative evaluative methods and principles will neither guarantee the rationality of scientific claims; nor will they put scientific research on the guaranteed path towards objectivity, or incorrigible 'knowledge' about the world. On the contrary, these methods will restrict the scope of evaluation procedure, and, as a result, the degree of accuracy in comprehending scientific inquiry. Neurath's understanding of science as the "historically located discursive practice" should be reconsidered as fruitful in this respect [Uebel, 1993: 605].

Secondly, Neurath's holism can be treated as a promising aspect of his view. Apart from Neurath's stressing of the coherence between currently accepted scientific beliefs, his holist understanding is important as it underlies the continuity in science, where one unity is gradually transformed into another unity. Such understanding helps to acknowledge that every scientific conjecture, every hypothesis comes out of a certain theoretical background. In turn, this explains developmental, step-by-step proceeding in science. Moreover, this manner of evaluation allows to correlate some important factors, such as the influences from socio-political and economical background, ambitions and personal interests of scientists, accessibility to measuring tools and experimental environments, which can play a role in the process of scientific activity but are usually neglected by normative accounts in the philosophy of science.

Lastly and most importantly, Neurath's approach should be reconsidered as it stresses the constitutional power of human's actions in the process of scientific inquiry. For Neurath, science was constructed by the collective efforts of society, so that the currently accepted set of statements reflected the level of scientific sophistication as it was formulated and incorporated by that society. In other words, science, in Neurath's terms, was a social construction[79]. In this respect, the crucial

[79] However, it should not be inferred that Neurath was a social constructivist, or had leanings to support that theory.

characteristics of scientific activity, such as the rationality of scientific knowledge and the reliability of scientific claims, cannot be efficiently comprehended by purely normative principles, since they do not embrace the participation and contribution of people in that activity. Appreciation of Neurath's approach allows to understand that rationality and reliability of scientific knowledge is specified in accordance with the totality of currently accepted scientific facts, which is in turn established by human's efforts. As an illustration, one can recall Neurath's boat metaphor once again:

> We are like sailors who are forced to reconstruct totally their boat on the open sea with beams they carry along, by replacing beam for beam and thus changing the form of the whole. Since they cannot land they are never able to pull apart the ship entirely in order to build it anew. The new ship emerges from the old through a process of continuous transformation [Neurath, 1913b/1996: 130-1].

From the metaphor it can be inferred that the maintenance, navigation and successful floating of a ship named science depends totally on sailors. In such a way, scientific activity reflects the accomplishments of society.

Neurath was stressing that the ship should always stay at the sea not because he supported subjectivism and relativism, and definitely not because he projected science as a chaotic enterprise. That was not his intension. He would rather deny the reliability of any foundational methods and norms in science because the 'evolution', or the historical development of scientific activity demonstrated the inefficiency of docking at a shore. Following Neurath's approach, changeability of all beliefs, notions and concepts was the key feature one had to accept if the aim was to *genuinely understand*, or appropriately interpret the process of scientific inquiry. Any unquestionable, unalterable norms reinforced upon scientific activity through philosophical, religious, political or other authoritative frameworks would only pull that activity backwards as an 'anchor'. In other terms, these norms would interfere with the process of 'evolution' of scientific inquiry, they would disrupt human will's essential need to be curious, to ask questions and to act in order to seek answers to that questions. Thus, Neurath's non-foundationalist approach

implies that, if a certain scientific method has to be established, it should not be delivered as a set of rigid postulates for the rational reconstruction of scientific activity. In that respect, for Neurath, there was no value in 'fixed' methodologies. However, this did not mean that science was irrational, merely instrumental enterprise. Objectivity and rationality were constructed by and through the process of scientific activity. Following Neurath's argument, the currently accepted harmony among scientific propositions was the most comprehensive, the most efficient 'bet' at reality. It was the most perfectly constructed ship to continue its (everlasting) journey at the sea.

The reconsideration of Neurath's approach allows to redirect the understanding of science away from the abstract and normative comprehension to the plane of practice and activity. In comparison with other views represented in the Vienna Circle, incorporation of Neurath's non-foundationalist account helps to get as closely as possible to the actual work of scientists. This gives an opportunity to conduct a more precise and more sensitive evaluation of scientific enterprise. In accordance with the aims of this dissertation, this aspect is the main legacy that is extracted from Neurath's position. However, it does not mean that this position is unquestionable. The main issue with Neurath's approach is that its holist characteristic clashes with its radical anti-metaphysical attitude. If science consists of the totality of currently accepted statements within the non-foundationalist framework, how one can claim for sure that no metaphysical assumption is accepted, or no metaphysical presupposition is overlooked? Without any criterion that will help to concretely identify metaphysical terms (which Neurath does not specify), there will be no guarantee that the existing unity excludes all metaphysical propositions or notions.

Neurath was aware of that problem:

> The *uncertainty* of all terms, sometimes greater, sometimes smaller, belongs to the nature of language. On it rests part of the efficiency of language. We must not forget either that we are constantly working with terms which we know are good at

> providing certain predictions, but on the other hand lead to yet unresolved contradictions at other places. Also we must get used to working with terms which we do not exactly know are 'usable' or 'not usable' - perhaps metaphysical. By sharp criticism one can hope to remove only some coarse errors and certain coarse nonsense; much remains uncertain at first, *though one cannot do without it.* One's back is *never* completely free, and working with 'dubious' statements has to be learned [Neurath, 1935a / 1983: 118].

Although Neurath realised that a certain criterion or other 'sifting' tool was needed to safe the anti-metaphysical feature of his account, his non-foundationalist attitude did not allow to introduce it:

> … There are always whole masses of statements under discussion with all their uncertainties, with all their subtle mathematical and logical parts. […] For our work there is no magical sieve at our command that would help to eliminate, automatically as it were, the terms and statements that easily lead to pseudo-problems. Sometimes we let formulations pass that we later reject as scientifically useless and therefore 'isolated' (metaphysical); equally we will often destroy valuable buds because we do not like to handle concepts and statements when we do not know exactly whether we can vouch for them [Neurath, 1936/1983: 137].

Neurath's radical attitude against metaphysics and his reluctance to accommodate supplementary tools for demarcation of genuinely scientific statements from metaphysical terms may be conceived as a limitation in his theory. Thus, the further analysis is necessary to understand what kind of metaphysics is destructive for science, or whether metaphysical assumptions are destructive at all. For instance, if one treats scientist's theoretical conjectures as independent of experience (i.e. not directly deduced from experience), but at the same time play a functional role in establishing a greater theoretical unity resulted in successful predictions, should they be dismissed from the totality of accepted beliefs as metaphysical? Or should they remain? What is, for instance, the status of conventions, which are eagerly incorporated in Neurath's account, but are apparently not (directly) deduced from experience? The task of the following chapters will be to shed some light on answers to these questions.

CHAPTER 4

FROM NEURATH TO QUINE: ASSESSING NEURATH'S HERITAGE

4.1. General Remarks

A detailed examination of Neurath's approach, conducted in the previous chapter, allowed to conclude that, notwithstanding certain limitations, this approach proves itself as an efficient candidate for an appropriate comprehension of scientific activity. In this context, monitoring the heuristic aspects of Neurath's view among contemporary philosophers of science will not only uncover how these aspects were carried to the theories of successor thinkers, but also will help to analyse whether Neurath's position was enhanced in content and structure to resolve its limitations. This, in turn, will aid the attempt to formulate an adequate present-day attitude towards scientific activity. In accordance with such a framework of analysis, this chapter will deal with the heritage of Otto Neurath as it is mirrored in the philosophical standpoint of Willard van Orman Quine (1908-2000). Particularly, the aim here is to demonstrate that Neurath's approach has affinities with Quine's doctrine of naturalism in a number of determining features, such as holism, the rejection of any foundations in science dictated from above science, the theory of language and protocol sentences as the bottom line of scientific inquiry. In the virtue of such resemblance, the assessment of Neurath's promising account will help to conduct an overall theoretical examination of deriving a contemporary, sober, and realistic view of scientific enterprise.

Although Neurath and Quine had similar attitudes towards science, it should be remarked that there was no close acquittance between these thinkers. When Quine

visited Vienna in 1932, Neurath was 'out of town', so they met in person only in 1939 [Creath, 2007: 334]. Moreover, it can be stated that this meeting did not result in a long-term correspondence, which could demonstrate Neurath's *direct* influence on Quine:

> In recent decades Quine was confronted by historians with the striking similarity of his views and Neurath's. Quine's response was to admit the similarity but to deny that he ever knew Neurath well or had read his work deeply. Indeed, he claimed, they did not meet until after Quine's basic ideas were formed. That does not preclude influence through third parties. But I see no reason not to take Quine's self-report here at face value [Creath, 2007: 336].

In these terms, it should be inferred that in the absence of person-to-person relation between Neurath and Quine, one is not in a position to claim that Quine adopted and further elaborated Neurath's approach. Rather, their views should be treated as resembling in crucial aspects but developed independently[80]. Thus, the process of monitoring Neurath's heritage is presented here as *conjectured* through the analysis of affinities between Neurath and Quine. From this perspective, the assessment of Neurath's legacy via Quine becomes even more illuminating. It will be remarkable to show how Neurath's approach, mirrored in resemblance with Quine's view (that was developed independently), which is accepted as one of the most influential positions in analytic philosophy of the twentieth century[81]. At the least, it will allow to demonstrate once again that Neurath's approach should not be underestimated, as it was during the time of the Vienna Circle.

---

[80] In his (1969a, 1969b) Quine makes use of Neurath's ship metaphor, described earlier in the text. From that one can conclude that Quine was acquainted at least with some hallmarks of Neurath's approach. Haller (1991b) states that Quine's reputation as a prominent philosopher even 'popularized' Neurath's metaphor, while other fruitful aspects of Neurath's account remained unnoticed.

[81] Here, it should be remarked that in the absence of direct influence of Neurath's approach on Quine's position, the similarities between these views described in this chapter may be rendered in a matter of historical coincidence. It is not questioned that Quine's goals and motivations in articulation of his understanding of science were different from those of Neurath. Thus, one is not in a position to assert any systematic connection between these views. Rather, the main intent in assessing Neurath's account through Quine's position is to stress that the issues Neurath addressed and the approach he advocated for is worth considering, since the same issues are underlined by such a remarkable philosopher as Quine, even by historical coincidence.

4.2. Neurath's Approach Reflected in Quine's Naturalism

Willard Van Orman Quine had many striking philosophical accomplishments throughout his academic career. Quine's criticism of analyticity and untenability of the epistemology based on the rational reconstruction from experience (*Two Dogmas of Empiricism*, 1951), or his questioning of the alleged belief that propositions in logic and mathematics are true by convention and thus purely analytic (*Truth by Convention*, 1949) are among the most memorable examples of Quine's philosophical success. All these apart, the current section will present the aspects lying behind Quine's critical attitude towards any foundationalist epistemology, pronounced in these articles – the aspects that constituted Quine's naturalism. Accordingly, the scope of analysis in specifying similarities between Neurath and Quine will be framed by these aspects.

4.2.1. Duhem-(Neurath)-Quine Thesis

The first and foremost similarity to be drawn between the views of Neurath and Quine is their holist understanding of the structure and operation of scientific inquiry. Nevertheless, it should be pointed out once again that the pioneer of holism was Pierre Duhem, who pronounced that science was a multi-layer, systematised representation of empirical data, formulated in the unity of accepted hypotheses:

> Experimental verifications are not the base of theory but its crown. Physics… is a symbolic painting in which continual retouching gives greater comprehensiveness and unity, and the *whole* of which gives a picture resembling more and more the *whole* of the experimental facts, whereas each detail of this picture cut off and isolated from the whole loses all meaning and no longer represents anything [Duhem, 1954: 204-5].

By indicating that the components of a theory did not possess much value separately, Duhem asserted his famous thesis for the genuine scientific test, which implied that the testing procedure should be conducted to the whole of a theory:

> …the physicist can never subject an isolated hypothesis to experimental test, but only a whole group of hypotheses; when the experiment is in disagreement with his predictions, what he learns is that at least one of the hypotheses constituting this group is unacceptable and ought to be modified; but the experiment does not designate which one should be changed [Duhem, 1954: 187].

In such a way Duhem made it clear that the falsification of a theory by a single counter-factual evidence was impossible; due to its complex structure[82], the anomalous observational result could only point that there was an inconsistency within the accepted whole.

As it was already specified, Neurath placed Duhem's thesis with all its implications to the centre of his non-foundationalist approach. But it was not just an adoption of the original thesis; Neurath correlated it in a way to functionally enhance his understanding of adaptive rationality without the postulation of unalterable 'anchors' in reality, not graspable by scientific means. Here is how Neurath elaborated Duhem's thesis in his non-foundationalism:

> If a statement is made, it is to be confronted with the totality of existing statements. If it agrees with them, it is joined to them; if it does not agree, it is called 'untrue' and rejected; or the existing complex of statements of science is modified so that the new statement can be incorporated; the latter decision is mostly taken with hesitation. *There can be no other concept of 'truth' for science* [Neurath, 1931b/1983: 53].

In *History and the System of Science in Otto Neurath* (1991b), Rudolf Haller classifies Neurath's contribution to Duhem's thesis as the "Neurath's Principle": when a new sentence stands in confrontation with the accepted totality of statements, necessary adjustments and elaborations are made either in the existing totality, or in the statement [Haller, 1991b: 38]. And although such disbalance is undesirable and challenging, there can be no pre-determined methods and guaranteed pathways for pointing out the exact source of the disbalance. According

[82] To recall Duhem's understanding of the structure of scientific theory, in addition to law-like theoretical formulations and experimental facts, it included the variety of additional assumptions and hypotheses, such as the choice of particular measuring materials and scales and their further systematic interpretation by a scientist, or the hypotheses from theoretical background.

to Neurath, scientists put all their efforts to sustain the harmony in the unity of scientific beliefs by the continuous 'trouble-shooting' process. Moreover, that is how scientific activity evolves – from resolving one confrontation to another, the totality of accepted statements transforms and gains new accomplishments. Here one can recall Neurath's ship metaphor, where the ship of science tries to stay afloat on the sea by the process of constant reformation:

> Duhem has shown with special emphasis that every statement about any happening is saturated with hypotheses of all sorts and that these in the end are derived from our whole world-view. We are like sailors who on the open sea must reconstruct their ship but are never able to start afresh from the bottom. Where a beam is taken away a new one must at once be put there, and for this the rest of the ship is used as support. In this way, by using the old beams and driftwood, the ship can be shaped entirely anew, but only by gradual reconstruction [Neurath, 1921/1973: 199].

Although Neurath clearly contributed to Duhem's holist understanding of science, philosophers of science frequently associate Duhem's thesis with Quine[83]. The reason for this may lie in Quine's precise and more systematic way of expressing his holism – he not only succeeded to clarify exactly how, within naturalistic framework, science was explained by means of science[84], but also supported his claims by demonstrating the inefficiency of foundationalist methods of scientific evaluation[85]. For his understanding of the process of experimental test in science, Quine incorporated a vocabulary very close to that of Duhem:

> Sometimes … an experience implied by a theory fails to come off; and then, ideally, we declare a theory false. But the failure falsifies only a block of theory as a whole, a conjunction of many statements. The failure shows that one or more of those statements is false, but it does not show which [Quine, 1969a: 79].

[83] Here the expression of 'Duhem-Quine thesis' is presupposed.

[84] i.e. how the ship of science was to be reconstructed without bringing it into a dock. Details on Quine's naturalism will be provided below in this section.

[85] As it was expressed in Quine's critical essays, such as "Two Dogmas of Empiricism" (1951) and "Truth by Convention" (1949).

Apart from that, for Quine, just as for Neurath (and for Duhem), knowledge consisted of the coherent whole of verified scientific statements:

> Implication is what makes our system of beliefs cohere. If we see that a sentence is implied by sentences that we believe true, we are obliged to believe it true as well, or else change our minds about one or another of the sentences that jointly implied it [Quine and Ullian, 1978: 41].

Quine's conception of scientific inquiry also clearly reflects Neurath's holist understanding of scientific enterprise as the product of activities of scientists [Quine, 1951: 39]. In this respect, it can be concluded that both Neurath and Quine saw the sailors as the principal constructors and navigators of the ship of science:

> We are after an understanding of science as an institution or process in the world, and we do not intend that understanding to be any better than the science which is its object. This attitude is indeed one that Neurath was already urging in Vienna Circle days, with his parable of the mariner who has to rebuild his boat while staying afloat in it [Quine, 1969a: 84].

To speak in more general terms, such a striking similarity between the views of Neurath and Quine with respect to Duhem's thesis is sometimes classified as holistic conventionalism (Haller, 1991a) or epistemological holism (Creath, 2007). One way or another, it can be stated that according to Quine and Neurath, truth as such is definable only through the currently established unity of scientific beliefs. There is nothing beyond that unity; especially, no ultimate philosophical principles or notions with absolute value that would guarantee the reliability of scientific knowledge. When the empirical test is concerned, it is applied to the totality of scientific statements, which is unescapable in the process of scientific development and at the same time is *essential for* the process of scientific development.

In short, one should pinpoint that although the holist theory of scientific knowledge was originated by Duhem and was further structurally elaborated by Quine, it should not be concluded that Neurath's contribution was insignificant and thus could be ignored. If that was the case, Quine would not mention Neurath's boat on

several occasions in order to illustrate the comprehensiveness of his position. Hence, in more precise terms, the expression 'Duhem-Quine thesis' can be complemented as 'Duhem-Neurath-Quine thesis', to do justice to all contributors in its formulation.

4.2.2. Non-foundationalism as the Defining Feature of Naturalism

From the previous sub-section, it was implicated that Quine and Neurath defined the structure of science in the similar manner. What about the general epistemological grounds of scientific activity? In other words, did Neurath's non-foundationalism, fitted well with his holist approach, coincide with Quine's naturalism at certain aspects? This sub-section will attempt to answer these questions.

It appears that Quine's naturalistic attitude towards science, which accepts holism in its heart, should resemble Neurath's non-foundationalism. Still, before making such a conclusion, a brief clarification on naturalism, particularly Quine's naturalism, should be provided.

Generally speaking, a naturalist approach intends to establish and explain all notions, processes and activities in science in scientific terms, without an appeal to philosophical, theological or other concepts and beliefs, which cannot be derived from the scope of science. For example, if one presupposes that the reliability of empirical claims is warranted by space and time as pure forms of intuitions, s/he attempts to place the source of knowledge beyond the scope of scientific vocabulary. On the other hand, if one believes that behind every empirical claim lies a set of scientific theories, such as those of neurophysiology, psychology, physics, etc, which provides the necessary grounds for comprehending certain observation, s/he is believed to incorporate a naturalistic explanation. This set of theories allows to understand how an observation is formed, how a human brain

processes sensory input to form a linguistically formulated output, or an observation.

Quine was a dedicated naturalist in that respect. He believed that a properly defined epistemology incorporated psychology, linguistics and (behaviouristic) biology as active contributors to the process of identifying the sources of scientific knowledge[86] [Quine, 1969a; 1969b]. Implication of any non-scientific conceptions was unnecessary, since science already contained the branches developed enough to explain how empirical knowledge was constructed and put forward in scientific hypotheses. Particularly, there was no functionality in philosophy which would dictate the merits of rationality and reliability of scientific activity. Thus, it can be inferred that Quine's naturalism was on a par with Neurath's non-foundationalism:

> …my position is a naturalistic one; I see philosophy not as an a priori propaedeutic or groundwork for science, but as continuous with science. I see philosophy and science as in the same boat – a boat which, to revert to Neurath's figure as I so often do, we can rebuild only at sea while staying afloat in it. There is no external vantage point, no first philosophy. All scientific findings, all scientific conjectures that are at present plausible, are therefore in my view as welcome for use in philosophy as elsewhere [Quine, 1969b: 126].

It can be maintained that Quine's (naturalistic) non-foundationalism, as expressed in the quote above, is not against philosophy, not *against* metaphysics as the burden pulling the ship of science to the bottom. Quine's view only suggests that in order to comprehend scientific knowledge, its sources and the scope of its application, no presuppositions postulated beyond science are necessary. Every aspect of scientific activity lies at the same plane of investigation. In this respect, Quine's naturalistic approach stands as less radical and conflicting with respect to the status of metaphysics in science. In general, one will be unable to observe in Quine's writings his strict and principal negative attitude towards metaphysics; he seems to

[86] Here it should be noted that Quine did not presuppose that psychology or evolutionary biology must be placed at the foundations of scientific activity. He rather meant to utilize these branches of science as the task of their investigation was to understand how subjects correlate with the world.

escape formulations as ‘metaphysics is meaningless and should be rejected’. From this perspective, Quine’s position appears as a milder alternative of the approach offered by Neurath[87]. To recall from the previous chapter, it was inferred that Neurath’s profound holism towards scientific activity did not coincide well with his radical anti-metaphysical position: it remained questionable how exactly one could be confident that the totality of accepted scientific statements excluded all metaphysical terms. Therefore, in order to discern whether Quine’s version of naturalism can aid to resolve this issue, it should be examined in more detail.

Neurath’s account of physicalism, which seeks the intersubjective (rational) value of empirical science through establishing the spatio-temporal structural relations between scientific statements, can also be classified as naturalistic. If both Neurath and Quine advocated for naturalism on the similar non-foundationalist grounds, should one prefer Quine’s account as less restrictive to metaphysical assumptions in science? Uebel (1992) states that one should be cautious in making such a preference: the analysis of Quine’s and Neurath’s naturalistic epistemology allows Uebel to conjecture that in the face of Neurath’s “rich” version of naturalism, that of Quine remains “restricted”, or incomplete [Uebel, 1992: 3]. To briefly refresh Neurath’s endeavours, he described scientific activity as a historical discourse, where socio-political and economic factors were treated as contributors to the process of gradual transformation (evolution) of statements on a par with physics, mathematics, biology, and other branches of formal and natural science. In other words, if naturalism attempts to explain ‘science in terms of science’, for Neurath it is natural and social science. These are taken together to keep the ship of science

[87] At this point one can suggest that Quine was not against metaphysics in principle, because he was not committed to the issue of rejection of metaphysics at all (as was the members of the Vienna Circle). In this context, it can be asserted that connecting Quine’s naturalism in resolving limitations of Neurath’s approach is irrelevant. Still, it should be noted that Quine’s attitude towards scientific activity clearly demonstrates his non-foundationalist stance. That, in turn, may aid for the enhancement of Neurath’s non-foundationalism. As the result, in case that all other key features of Neurath’s position are preserved in that of Quine, it can be conjectured that Neurath’s anti-metaphysical stance can be preferred in favour of Quine’s milder version of non-foundationalism. However, as will be uncovered in the following paragraph, Quine’s naturalistic method remains incomplete against Neurath’s approach.

afloat. In comparison with Neurath, Quine's naturalism is rather limited, since for Quine scientific knowledge is grounded in "neurophysiology, evolutionary biology and behaviouristic psychology" [Uebel, 1992: 2-3]. Such understanding of the sources of knowledge is by no means inconsistent with non-foundationalism or holism, but it leaves aside the features that play an active part in the process of formulation of scientific claims:

> Together with the recognition of the historicity of the concept of knowledge and of the general social determinants of the practice of science, this leads to including history and sociology in the naturalistic theory of science. Theory acceptance is understood as determined not only by internal methodological conventions and biological, psychological and linguistic facts but also by factors such as the organisation of science, the potential use of the research results, the funding of research programs, as well as general sociohistorical conditions like the state of development of the productive forces. This sociopolitical dimension of Neurath's conception of the "science of science" is clearly lacking in Quine's [Uebel, 1996b: 92-3].

Accordingly, one can infer that although both Neurath and Quine believed in self-sufficiency of scientific enterprise, in the sense that all epistemic and structural tools for interpretation and understanding of scientific activity lied within science itself, Neurath's naturalistic approach was broader in scope than that of Quine. Quine's escaping of any eminently negative attitude towards philosophy and metaphysics may appear as more advantageous in rounding the sharp edges of Neurath's anti-metaphysical formulations. However, such a mild attitude will not resolve the tension between holism and naturalism[88], which was posited as a challenge for Neurath's approach in the previous chapter. On the other hand, leaving the social, economic and political aspects of scientific activity apart from the ship of science will mean taking away the crucial boards utilised for its reconstruction, which may increase the chances of sinking.

[88] As Quine supports both theses, it is easy to implicate that metaphysical (i.e. not verified by science) claims will not be accepted in Quine's totality of statements he calls science. Quine's naturalism does not eliminate the distortion between naturalistic epistemology and holist structure of science by avoiding any strict vocabulary against metaphysics; remaining silent about the problem does not dissolve the problem.

In general terms, this sub-section took a brief examination of the affinities between epistemologies of Neurath and Quine. It can be concluded that notwithstanding certain restrictions of Quine's position, both thinkers agreed on the non-foundationalist, purely scientific understanding of the sources of empirical knowledge. The aim of the next two sub-sections will be to monitor the similarities between Quine and Neurath in the details of their theories of science – it will be demonstrated that Quine's and Neurath's attitudes towards language and basic observational reports (protocol sentences) are reinforcing their naturalistic views in the same manner. Accordingly, it will be shown how Neurath's heritage is mirrored in Quine's approach in science to the substantial degree.

4.2.3. Language: The Underlying Tissue of Scientific Inquiry

As it was examined in the previous chapter, the intersubjectivity of empirical statements was one of the essential characteristics of Neurath's approach. In this context, language gained special significance – it was, for Neurath, the tool for expression and communication, and thus promoting "the scientific conception of the world". For Neurath, a meaningful (i.e. scientific) inquiry presupposed the correlation of facts expressible linguistically (i.e. testable intersubjectively). Moreover, it was the only 'medium' through which the coherent whole of the accepted statements was established. In this respect, the physicalist language served as the bottom line for all epistemological considerations – no other ultimate reference to 'reality' or 'truth' was feasible in principle. Language (the unity of scientific statements), according to Neurath, depicted the accomplishments in science till the latest stage of development; through language one could trace the historical character of scientific progress: "Language is essential for science; within language all transformations of science take place" [Neurath, 1931b/1983: 54]. Due to this factor, language, reflecting the course of scientific inquiry, possessed the same features – its vocabulary and syntactic rules were not rigidly predetermined, they underwent the process of transformation and reconstruction when it was

necessary. Therefore, Neurath's language was floating, together with science, on the non-foundationalist boat and was reflecting the route of a vessel.

Since Neurath and Quine displayed the similar epistemological attitudes towards scientific activity, it will be no surprise to find out that Quine defined language in the way close to Neurath: "language is social and so depends for its development upon intersubjective reference" [Quine, 1951: 42]. In order to reinforce the intersubjectivity criterion of scientific language, Quine detailed his view by claiming that certain terms, such as 'I', 'you', 'here', 'this', etc.[89], should be avoided in scientific expression. Apart from this, the language of science would usually involve symbolic (generalized) abbreviations, such as variables (denoting objects), predicates and quantifiers, which could be structurally connected and operated by means of the inferential rules of logic[90] [Quine, 1957: 9-10]. In such a way, the verifiability (intersubjective testability) of scientific statements could be comprehensively achieved.

Alongside the intersubjective feature of language, Quine, just as Neurath, stressed that language was not a secondary aspect of science, it was carried hand-in-hand with scientific activity; by means of language people were educated and learned about the world as it was depicted by science [Quine, 1957: 5]. For this reason, language for Quine was an epistemological tool that reflected scientific achievements, it had to evolve together with the course of scientific activity. For instance, in 1957, Quine determined the framework of science as expressed in

> …the notion of physical object, the four-dimensional concept of space-time, the classical mould of modern classical mathematics, the true-false orientation of standard logic, and indeed extensionality itself [Quine, 1957: 16].

[89] Quine generalized them as "indicator words" and "egocentric particulars" [Quine, 1957: 8].

[90] Here Quine did not suggest that language obeyed the rules of logic. This would be contrary to his criticism of analyticity and reductionism, described in "Two Dogmas of Empiricism". Rather, it should be understood that, according to Quine, science operated with general, systematized statements and propositions, which were normally structured by logical inferences, such conjunction, disjunction, etc.

From this quote it should not be presupposed that Quine specified the ultimate foundations of science. Instead, it should be conceived as Quine's (1957) definition of the scope of scientific enterprise, as it was expressed by and learnt from language. Drawing a parallelism with Neurath's approach, one can assert that the definition, described in the quote, is Quine's formulation of Neurath's physicalistic language.

Another feature of Quine's theory of language that deserves closer attention with respect to similarity with Neurath is the indeterminacy of translation [Creath, 2007: 340]. Basically, this aspect of Quine's approach indicates that since a scientific framework is evaluated and tested by the totality of statements it incorporates, each component gains meaning through that totality, so, taken in isolation, it may not have any distinct, unique denotation: " a statement about the world does not always or usually have a separate fund of empirical consequences that it can call its own" [Quine, 1969a: 82]. This claim has a number of implications. Firstly, it can be gathered that Quine remains faithful to holist understanding of science, since the indeterminacy of translation suggests that there always be a variety of theoretical denotations[91] to one experimental result. Here indeterminacy, not underdetermination should be intended, since for Quine (as it is for Neurath), there is no guarantee which alternative for translation has more value, or will enhance the total efficiency of a scientific framework [Creath, 2007: 341]. It can be further conjectured that the choice of a certain translation is conventional, so only through application of a certain denotation scientists will understand whether the decision to accept the translation was correct or it should be modified, or even altered completely. The aspect of indeterminacy of translation may be the reason why the positions of Neurath and Quine are characterised within the scope of holistic conventionalism [Haller, 1991a].

[91] i.e. establishing the linguistic connection between the experimentally verified result and its theoretical translation, or formulating a term (word).

The roots of such holistic conventionalism can be traced back to Duhem. When Duhem was providing his understanding of structure in science, which further was crowned with the famous thesis, he introduced the difference between practical and theoretical facts [Duhem, 1954: 134]. Generally speaking, a practical fact is a crude observation of a certain phenomenon. For example, the statement 'it appears that the length of this piece of paper is about 7 centimetres' can be treated as a practical fact. On the other hand, in accordance with the measuring tools available, one can generate a couple of theoretical (i.e. testable) facts, or strictly defined formulations of a certain phenomenon: 'the length of this piece of paper is 7.01 centimetres'. If a more accurate tool is available for the measurement, then the fact will be written as 'the length of this piece of paper is 7.011 centimetres', and so on. This example can be taken as an illustration of the indeterminacy of translation. It also demonstrates that the creative work of a scientist should not be underestimated – being bound to the limits of measurement, s/he should either correlate his/her mathematical structure, or invent tools, theoretical and experimental, for the proper establishment and testing of his/her theory. By the same token, Neurath's stressing on the social aspects of scientific activity is crucial; if the formulation of scientific statements can be performed in the variety of ways, these aspects of scientific activity have to be included in the appropriate understanding of scientific enterprise. By considering them, one can uncover more precisely what decisions scientists make with respect to translation of an observational fact to the particular theoretical designation, and how this decision affects the overall predictive power of a theory.

The importance of social aspects[92], which can navigate scientists' decisions in the process of selection of definite theoretical designations, can be reinforced by Neurath's notion of imprecise terms (*Ballungen*). To recall from the previous chapter, Neurath believed that the language of science could not be constructed on

[92] Such as the accessibility to precise measurement apparatus, described in the example from the previous paragraph.

the strictly normative grounds from experience (as some other members of the Vienna Circle assumed), since it was a mixture of precise and imprecise terms:

> What is first given us is our historical ordinary language with a multitude of imprecise, unanalysed terms ['*Ballungen*']… If we want to embrace the entire unified science of our age, we must combine terms of ordinary and advanced scientific languages, since in practice, the terms of both languages overlap. There are certain terms that are used only in ordinary language, others that occur only in scientific language, and finally terms that appear in both. In a scientific treatise that touches upon the whole range of unified science, therefore, only a 'jargon' that contains terms of both languages will do [Neurath, 1932/1983: 91-2].

As every observational statement could be interpreted in the variety of ways, and certain interpretation had to be chosen by a scientist in the course of his/her work under the impact of the variety of (internal and external) factors[93], not every term was reducible to the level of protocol sentences. That was how, together with an active contribution of a scientist, Neurath's language of science constituted a 'jargon', quite suitable for his adaptive conception of scientific activity. Although Quine did not specify the language of science as a 'jargon' incorporating precise and imprecise terms, it can be conjectured that such a position would not fall contrary to his holist understanding of scientific language.

In general, it can be no doubtfully stated that Quine's view went parallel to Neurath's approach with respect to the language of science. It can be put forward that Quine succeeds to specify his theory of language in a more detailed manner: he describes it by means of a more concrete vocabulary. Besides, the indeterminacy of translation, advocated by Quine, aids the comprehension of holistic conventionalism, supported by both thinkers, from a better structured, or better formulated perspective. Therefore, it can be asserted that Quine's theory of

[93] By 'internal' factors, theoretical, or factors within the scope of science are presupposed. External factors correspond to social and personal impacts in the process of the work of a scientist. The brackets are used since it appears unclear why should one divide these impacts on internal and external, when it is more practicable to take all of them under consideration.

language furnished Neurath's approach with a more appealing, easily digestible formulation[94].

4.2.4. The Given: Protocols and Observation Sentences

Since one of the distinctive features of Neurath's approach is his understanding of the given in the form of intersubjectively testable protocol statements, it will be beneficial to assess how Quine's position in this respect mirrored that of Neurath. To refresh the examination of protocol sentences from the previous chapter, Neurath defined protocols as the basic observational reports expressed in a particular form, which should include spatio-temporal relations and fix the name of an observer for the possibility of testing by other subjects[95]. Such form of protocol statements furnished the functionality of physicalism, particularly physicalist language. In turn, incorporating physicalist language helped to facilitate the rational links among scientific claims (i.e. supplemented a way towards the unified science).

In Quine's approach, the notion of protocol statements as the basis for empirical (scientific) claims and generalizations also played a central role. Quine did not use the term 'protocol', he preferred the denotation 'observation sentences' [Quine, 1969a; 1975; 1978]. According to Quine,

> Observation sentences are the bottom edge of language, where it touches experience: where speech is conditioned to stimulation. It is ultimately through them that language in general gains its meaning, its bearing on reality. This is why it is they that convey the basic evidence for all belief, all scientific theory. […] An observation

[94] It should be underlined that while inferring to Quine's more well-articulated formulations with respect to those of Neurath here, it is not assumed that Neurath was actually the forerunner of all Quine's theses, and Quine's philosophical achievements should be appreciated merely because he succeeded to complement Neurath's approach. Nor it is attempted to represent Quine's theory of knowledge merely as a systematising framework for Neurath's non-foundationalism. In general terms, the fact that Quine is treated as one of the most influential analytic philosophers of the twentieth century due to his great accomplishments in logic, mathematics, philosophy of language and philosophy of science is not questioned here to any extend.

[95] For the detailed description of Neurath's format of protocols, see p. 18 of the Chapter 3.

> may be made by an individual; but, as we have emphasized, the truth of the observation sentence is an intersubjective matter [Quine and Ullian, 1978: 28].

It is evident that Quine sees observation statements in the form of immediate expressions of observed phenomenon[96]. It should be noted here that for Quine, observation sentences stand as empirical 'filling' for all scientific claims, but only as far as they are expressible in a language, not as the incorrigible foundations for establishing reliability of scientific claims. To this end, observation sentences are the keystones of meaning, which "we are in a position to learn first, both as children and as field linguists", and, just as Neurath's protocols, are the bearers of verifiable scientific knowledge – they stand as "the repository of evidence for scientific hypotheses", but only within the framework of naturalistic epistemology [Quine, 1969a: 88-9]. Apart from this, every statement accepted in science is open to revision; observation sentences are not the exception[97]. In this respect Quine's theory is consonant with Neurath's approach.

It is eminent that for Quine, just as for Neurath, the intersubjectivity criterion, as one of the underlying features of non-foundationalist attitude towards science, is implemented in their view of observation (protocol) sentences. Quine clearly signifies that observation statements should be qualified as empirical reports "on which all speakers of the language give the same verdict when given the same concurrent situation" [Quine, 1969a]. In other words, the value of protocol

[96] In order to make a further clarification on Quine's understanding of observation statements, one can consider Quine's classification of occasion and observation statements. Occasion sentences, such as 'This is rabbit' or 'His face is dirty', gain meaning through the concrete assent or dissent at the moment of stimulation, or being exposed to the object or situation in question [Quine, 2013: 32]. In connection with this, observation statements are

> the occasion sentences on which there is a pretty sure to be firm agreement on the part of well-placed observers. Thus they are just the sentences on which a scientist will tend to fall back when pressed by doubting colleagues [Quine, 2013: 38].

[97] Still, Quine [1975: 314] specifies that observational statements are questioned by scientists in the last place – due to their empirical nature a scientist will usually turn his attention firstly to the theoretical components of a hypothesis, and only if nothing works, will proceed to moderate the observational reports. In this context, theoretical constituents are more exposed to holism.

(observation) sentences is established by means of intersubjectively accepted (or intersubjectively verified) reports, which are expressed in the same way, structurally, by all subjects exposed to a certain phenomenon. For this reason, the process of 'grounding' of scientific knowledge is connected to semantics and linguistics, including the social factor of these branches of research. In such a way, observation sentences constitute the link between empirical input and theoretical output, they serve representational 'content' to be further put in theoretical operation and transformation in scientific hypotheses.

If Quine saw observational sentences as the 'inventory' of scientific hypotheses, how did they enter the language of science? In other words, did Quine specify a concrete format for scientific observational reports, as Neurath did, or could any statement in the form of crude ostensive description be incorporated by a scientist? Quine treated this issue with scrupulousness as well. Following the holist framework, Quine stressed that observation sentences were not presented in science in the form of crude sensational reports. Rather, they were entering science as refined, or "distilled" ("pegged") observational statements, expressed in appropriate language[98] and including spatio-temporal connections, in order to avoid private, subjective formulations [Quine, 1975: 315-7]. In general terms, observation sentences were entering scientific inquiry as objective (i.e. systematically verified in reference) generalisations in the conditional form:

(If [pegged observation sentence], then [pegged observation sentence]).

In other words, "theory implied observation conditionals" [Quine, 1975: 318]. Quine proposed such a formulation of observation sentences not because he wanted to overcomplicate his theory of science. Rather, Quine tried, within the holist framework, to signify that even the most easily comprehensible components of a scientific theory, such as observation statements, had a composite structure.

[98] By 'appropriate expression' it is meant stating an observation in the intersubjectively accessible form, i.e. 'The piece of paper on the desk is 7.01 centimetres long'.

Scientists did not use crude, 'naked' observational reports, such as 'Here now brown table'. They worked with these crude reports in order to represent them in the form of systematic empirical data that could be utilised properly within and for the sake of a theory. Thus, the examination and resolution of a confrontation between an accepted scientific framework and recalcitrant evidence became a very delicate, time and effort consuming procedure, which was left to the hands of scientists. To emphasize once again: the work of scientists is crucial in the process of scientific inquiry. Only by the efforts of sailors the ship of science can stay afloat. That is why the factors (social, economic, political), which help to conduct an appropriate evaluation of scientific inquiry, should not be ignored. It can be maintained that, exactly for this reason, Neurath stressed that these branches of science should be incorporated in the scientific conception of the world. Hence, the previous remark on the encompassing character of Neurath's approach over that of Quine in this respect gains another confirmation.

When comparing the format of observational reports, Quine's observation sentences appear to be defined in a simpler and more appropriate manner: it seems as if Quine's format is more relevant to the actual practice of scientists than Neurath's multi-layer one[99]. One may argue that Neurath's lengthy way of protocolling is not functional, and thus may not be preferred and applied by scientists[100]. However, this issue may be resolved if the following clarification is made. To recall the examination of previous chapters, Neurath proposed this particular format within the context of the protocol sentences debate with Schlick

[99] To recall Neurath's 'multi-layer' protocols:

> "Otto's protocol at 3:17 o'clock: [Otto's speech-thinking at 3:16 o'clock was: (at 3:15 there was a table in the room perceived by Otto)]" [Neurath, 1932/1983: 93].

It appears as if a scientist will not prefer such a lengthy formulation of *every* observation statement s/he constructs in the course of his/her work. Quine's format is allegedly more economic in application, so-to-speak.

[100] Here one can question to what extend it is efficient to display that every empirical report, every reference to empirical data is presented in the form proposed by Neurath.

and Waismann. Where Schlick and Waismann were calling for subjective affirmations as unshakeable basis for empirical knowledge, Neurath remained committed to the non-foundationalism and claimed that no unalterable epistemological assumption will survive the process of change and transformation in science. Still, Neurath also believed that science was a rational activity. For this purpose, he put forward his, complicated at the first sight, format of the protocol sentences. Not only this format enhanced the value of intersubjective checkability, but also established spatio-temporal relations with an observer in a manner that aided to demarcate actual protocols from hallucinations and other 'non-reality' statements [Uebel, 1993]. As for the rest, it can be conjectured that Neurath would agree that the formulation 'There is a table in the room' could be accepted as an observational protocol in most occasions. Consequently, Quine's observation sentences and Neurath's protocols would not differ in the degree of precision and functionality.

In general terms, the examination provided in this section allows to infer that Quine and Neurath had approaches in science quite similar in all their defining aspects. It is remarkable that, even in the absence of direct influence, Neurath's efforts for the fruitful, positive understanding of science were supported and maintained by such a prominent thinker as Quine. Accordingly, the next section will present the general evaluation of the affinities between Neurath and Quine; particularly, by connecting the examination conducted in the last two chapters, it will summarize whether the uniqueness of Neurath's approach is carried and/or enhanced by Quine's naturalism.

4.3. Was the Uniqueness of Neurath's Approach Carried by Quine?

The previous section signified the insights of Quine's view through its comparison with Neurath's approach. In order to generate an appropriate summary of Neurath's heritage as it was carried by Quine, the overview of Quine's account in science

should be presented. According to Quine, the aim of scientific inquiry was the "search for systematic simplicity in theory and evidence" [Quine, 1957: 6]. This simplicity was established through the language of science, a social tool which served as a connecting tissue between subject and object, theory and evidence. In this context, language mirrored the structure of scientific activity. Quine's understanding of scientific structure can be summarized as follows. The bottom level of scientific inquiry was constituted by observation sentences – intersubjectively verifiable observational reports, which were further systematically processed and manipulated by scientists to formulate scientific hypotheses and theories, correlated by implication into the coherent whole of scientific truths, or verified beliefs about the world [Quine and Ullian, 1978: 28, 41-65]. The reality was represented by this whole of beliefs; no further underlying principles and notions were necessary. Science was self-sufficient in that respect: it had, Quine believed, all the inventory to ground and explain all its endeavours. In general terms, Quine advocated for the holist position towards science on the grounds of naturalist epistemology. Quine's holist standpoint was so well-established that contemporaries began to associate Duhem's thesis with Quine's accomplishments in that respect.

Regrettably, the views of Duhem and Quine were not associated with Neurath. Notwithstanding the fact that Quine was referring to the Neurath's ship metaphor in some of his writings, the resemblance between Neurath and Quine did not increase the value of Neurath's approach as a distinctive contribution to holism in particular and philosophy of science in general. The reason for this may lie in the fact that Neurath was the member of the Vienna Circle, and the standard interpretation of the Vienna Circle limited the appropriate understanding of the movement. Fortunately, the recent examinations in the history and philosophy of the Vienna Circle allowed to re-establish the promising heritage of Otto Neurath, and assess its antecedents in the work of Quine.

How, then, can one track Neurath's heritage in Quine's work? What aspects of Neurath's unique position echoed in Quine's accomplishments, so that such heritage can be rediscovered? As far as these thinkers developed similar accounts without a direct influence, another question may be asked: did Quine's understanding of science surpass that of Neurath, so the fruitfulness of Neurath's approach could be ignored?

The examination conducted in this chapter allows to state the following: Quine and Neurath defended an attitude towards science, resembling in all major characteristics: (Neurath's) non-foundationalism and (Quine's) holism, (Neurath's) physicalism and (Quine's) naturalism, language as an underlying correlating tissue between subjects and objects, and lastly, (Neurath's) protocol and (Quine's) observation sentences as the intersubjectively established grounds of scientific inquiry. At the same time, it should be remarked that Quine's scrupulous and detailed method of expression and articulation of his theses facilitated an easier comprehension of the aspects shared by Quine and Neurath[101]. At least this factor was detected in Quine's explanation of Duhem's thesis, or his conception of indeterminacy of translation.

Nevertheless, it was also detected that Quine's understanding of science was restricted to a certain extend. Since Quine's naturalism, or self-sufficiency of science in explaining the sources of knowledge, principally involved natural science; the factors, impacting scientific practice from socio-political and economic aspects of research remained out of the evaluative inventory. Staying limited to his thesis of indeterminacy, Quine only suggested that

> A substantial mass of theory, taken together, will commonly have experiential implications; this is how we make verifiable predictions. We may not be able to explain why we arrive at theories which make successful predictions, but we do arrive at such theories [Quine, 1969a: 79].

[101] Of course, here one should keep in mind that this factor does not attempt to understate Quine's philosophical success. See footnote 94 for details.

One may not be able to explicate precisely how scientists arrive at successful theories; however, taking on account such factors as sophistication and accessibility to measuring tools, the economic and political circumstances in which scientists perform their research, the availability of funds and grants to run laboratory experiments where necessary, even personal ambitions and interests of scientists – all these may furnish for the more appropriate, more accurate evaluation of scientific activity. Moreover, if one accepts a holist, non-foundational conception of science, the role of decisions and conjectures made by scientists becomes crucial, hence it have to be attributed as clearly as possible. At this point, the social aspect of scientific inquiry can again serve as a tool for comprehension. In this context, Neurath's methodological grounds for explaining scientific knowledge are more salient and beneficial for the process of evaluation. In short, it can be stated that Quine did reflect the promising features of Neurath's approach, only with a restriction. Such restriction does not imply the failure of Quine's theory of science; it is rather a matter of methodological preference on which account to follow in accordance with the aims of evaluative process. At least it is not a constraint to conclude that Neurath's approach can be re-established and can be considered as a plausible contemporary account in the philosophy of science. As far as the goal of this chapter was to assess the applicability of Neurath's approach through its similarities with Quine's position in science, which stands as one of the most well-articulated contemporary positions, this goal was accomplished.

Another essential factor to be mentioned here is the discrepancy between holism and anti-metaphysical attitude, posited as a challenge to Neurath's position at the end of the previous chapter. It can be pointed out that Quine preferred to remain silent about the issue of metaphysics in science[102]: every phenomenon, every inquiry should be grasped within the limits of language, or on the plane of language. Searching for the ultimate reality underneath linguistically-expressed experience,

[102] Earlier in this chapter, that factor even suggested to characterize Quine's view as 'milder', or less radical with respect to Neurath's position.

or doubting the content of sensory experience was “needless”; it was more feasible for Quine to trust the senses and simply to “accept physical reality” [Quine, 1957: 2]. Moreover, Quine remained committed to the non-foundationalist understanding of science, just as Neurath did, although he admitted that such position would never warrant the absolutely reliable scientific knowledge:

> Whatever we affirm, after all, we affirm as a statement within our aggregate theory of nature as we now see it; and to call a statement true is just to reaffirm it. Perhaps it is not true, and perhaps we shall find that out; but in any event there is no extra-theoretic truth, no higher truth than the truth we are claiming or aspiring to as we continue to tinker with our system of the world from within [Quine, 1975: 327].

Apart from that, Quine did not express any radically negative attitude towards metaphysics. However, as it was mentioned above, remaining silent or inviting to trust science is not a sufficient enough strategy for the solution of the issue. In such a way, the dissonance between holism and anti-metaphysical stance remains as a challenge, both to Neurath and Quine.

A further remark should be made here on the issue of disbalance between holism and anti-metaphysical stance in Neurath’s account. After a detailed examination of the affinities between the positions of Neurath and Quine, it may appear as if Neurath’s rigorous fight against metaphysics was too overestimated: one can assert that maintaining a non-foundationalist position in the Quine’s way, who proposed to restrict the scope of meaningful inquiry to the plane of scientific language and preserve a non-commitment attitude towards metaphysics will be enough to promote an adequate account of scientific activity. However, it should not be forgotten that Neurath’s efforts against metaphysical notions and postulations were conducted not merely in order to radicalize his non-foundationalism. Neurath, as the member of the Vienna Circle, was advocating for his non-foundationalism in a quite suppressive social and political background. The escalation of Nazism in Central Europe and its rise to power in Germany and Austria demonstrated how destructive and disastrous an authoritative approach could be. As sociologist and political activist, Neurath could more sensitively comprehend such drastically

negative effects of authority. In this context, it should be pinpointed that Neurath's non-foundationalism was reinforced by radical anti-metaphysical stance due to his delicate understanding of the restrictive power of authoritative, dictated merits and norms, that should be avoided in an effective account of scientific activity.

In any case, the resolution to the tension between Neurath's holist understanding of scientific inquiry and his fight against metaphysics remains incomplete. To this, another challenge can be supplied. If, as Neurath and Quine project, there is no value behind the coherent totality of accepted scientific beliefs, how can one firmly acknowledge that science is not a fairy-tale, or vicious illusion constructed by scientists? If, at the certain points of research, scientists are endowed with tools (conventional agreements) that can decisively determine the course of scientific activity, an irrelevant, nonsense, 'metaphysical' piece can be well incorporated as 'scientific'. The empiricist aspect of science might then be lost. Karl Popper, in his *Logic of Scientific Discovery* (1934/2002), referred to this issue in Neurath's non-foundationalism while questioning his understanding of protocol sentences:

> We need a set of rules to limit the arbitrariness of 'deleting' (or else 'accepting') a protocol sentence. Neurath fails to give any such rules and thus unwittingly throws empiricism overboard. For without such rules, empirical statements are no longer distinguished from any other sorts of statements. Every system becomes defensible if one is allowed (as everybody is, in Neurath's view) simply to 'delete' a protocol sentence if it is inconvenient [Popper, 2002: 78].

The specific scope of this dissertation does not allow to provide the details of Popper's solution to the issue described in the quote above; neither it is intended to suggest that Popper's account of science is in any terms preferable. The efficiency of Neurath's approach is believed to be undeniable. However, it is also believed that as long as one tries to comprehend the structure and implementation of science as the only source of empirical knowledge, the general empiricist understanding should be carefully preserved as much as possible. Therefore, at least certain (systematizing) criteria, or guidelines should be implemented to help to classify a

particular research as *genuinely* scientific[103]. In the light of these challenges, the last chapter of this dissertation will discuss the possible alternatives for an appropriate elaboration of Neurath's approach.

[103] Here one can think of demarcation criteria that allow, to a certain extent, to separate scientific 'knowledge' from metaphysical terms.

CHAPTER 5

CONCLUSION: HOW METAPHYSICS IS INDISPENSABLE IN SCIENCE?

In accordance with the examination conducted in this dissertation, one can maintain that the Vienna Circle should not be treated as the group of reductionists with strictly positivist inclinations, who unanimously favoured the linguistic turn in philosophy that aimed at the rigorous demarcation between scientific (meaningful) and metaphysical (meaningless) propositions. Such a misconception in representing the Vienna Circle, established mainly by the standard interpretation of the movement, restricts the effective analysis of the Circle and limits the valuable content of its main tenets. Fortunately, the reconsideration of the Vienna Circle allows to uncover the following: the Circle, which included highly influential scientists and philosophers as its members, leaved the variety of views and approaches as its heritage to successors. In other words, as was already specified in chapter 2, although all members of the Vienna Circle were consonant with the general motivational lines in their discussions, they succeeded to advocate for their own, unique positions – one can recall the protocol sentences debate and further 'split' of the members to foundationalist and non-foundationalist wings as an example. In this context, the rediscovery of the *views* of the Vienna Circle is important as it helps to detect the fruitfulness and functionality of its premises in a more comprehensive manner. Specifically, it allows one to articulate a more accurate understanding of the Circle's position towards metaphysics. In accordance with the standard interpretation of the Vienna Circle, it was presupposed that all of the members were against metaphysics, or any statement that could be neither classified as analytic nor as synthetic. However, the examination conducted in this dissertation allowed to infer that the members of the Vienna Circle did not reject

metaphysics *in toto*. It will be more accurate to assert that members of the Circle rejected the authoritative reign of metaphysics over science. They were alienated by any assumption, any notion and any conception that claimed incorrigible status with no room for being questioned and subjected to empirical test. In this respect, religious and political dogmas could in no way navigate the course of scientific inquiry: they were rejected by the Vienna Circle as 'metaphysical' in the first place. This aspect gained special importance as the authoritative powers of Nazism were accumulating in the Central Europe at that time. It can be concluded that the Vienna Circle's rejection of metaphysics was a politically necessitated move.

Apart from that, one can conjecture that, in general lines, the members of the Vienna Circle were sceptical about metaphysics as an independent source of knowledge. As the protagonists of the "scientific world conception", the members of the Circle believed that a sober, comprehensive account of the world should be based on science and science only, i.e. should incorporate the empirically verifiable statements[104]. Since metaphysical statements, such as 'God is omnipotent', or 'Time and space are absolute' were not empirically verifiable, they were classified as "meaningless", but concluding that the Vienna Circle totally rejected metaphysics as a meaningless enterprise was a bit exaggerating. Rather, it would be more appropriate to maintain that the members of the Circle excluded metaphysics from the scope of scientific knowledge, i.e. *testable* knowledge:

> I think that it is not sufficient to characterize metaphysical statements as "meaningless". There are a lot of meaningless statements which are not all "metaphysical". […] Metaphysics, according to our way of speaking, is certainly meaningless from the scientific viewpoint because the terms "true" or "false" cannot be applied to these statements [Frank, 1948: 277-8].

[104] As described in the chapter 2, Schlick and Neurath had different accounts on how a proposition should be empirically verified by means of the given, and what should be accepted as 'truth'. It is not neglected here. That is why the remark about "the general lines" is put at the beginning of the paragraph.

Not only Frank pointed to the exact manner in which the Vienna Circle 'rejected' metaphysics. Neurath, who appeared to display the most radical position against metaphysics through his non-foundationalist approach, admitted that metaphysical assumptions, although meaningless (i.e. not empirically verifiable), could still act as a "stimulus" in order to achieve greater predictive success[105] [Neurath, 1959: 300].

In general, one can infer that the Vienna Circle's rejection of metaphysics was not incorporated merely to reinforce the aspects of its approach, mainly the demarcation between meaningful and meaningless statements by means of the verification principle. Instead, the heritage of the Vienna Circle in that respect should be taken as a necessary step towards reconceptualization of the process of scientific activity in the light of the progress in the various fields of science at that time. Notwithstanding the plurality of views accommodated within the Vienna Circle, all of its members were convinced that scientific inquiry could make accomplishments without the burdens of dogmatic, unalterable norms and postulates. The members of the Circle, following the spirit of Enlightenment, believed that science was the *only* sufficient source of knowledge, hence the authoritative constraints of any untestable (i.e. metaphysical) assertions, notions and theories should be withdrawn. In short, the reconsideration of the Vienna Circle allowed to conclude that, although members had different attitudes towards the matters discussed within the Circle, their common goal for spreading "the scientific world conception", or, in other words, their mutual aim in the fight against metaphysics was the fight against *authority in any plane of inquiry that claimed reliability*. One should consider this aspect of the Vienna Circle's approach as promising in the first place.

[105] Apart from Frank and Neurath, Schlick (1981a) also specified that metaphysics could not be treated as the source of higher-order absolute knowledge. Instead, in Schlick's terms, the main task of metaphysics lied in the process of ordering and coordination of scientific statements, by providing 'the inventory' for the logical analysis of language.

In the context of the reassessment of the Vienna Circle's promising heritage, the detailed examination of Neurath's approach has a number of advantageous implications. First and foremost, it demonstrates that Neurath's stressing on the non-foundationalist approach in science within the Vienna Circle is motivated by his alienation from authority gained through his insight in economy, sociology and politics. It can be conjectured that Neurath, who developed his account of science in accordance with his experience as economist and his socio-political endeavours, could vividly foresee the consequences of accepting any proposition, norm or attitude as incorrigible[106]. Among the members of the Vienna Circle, Neurath was one of the most ardent defenders of non-foundationalism in science because he acknowledged that incorporating an unchangeable fundament in the web of knowledge would inevitably restrict the progressive, innovative endeavours of scientific activity. In other words, Neurath was specifically against authority because his experience in social sciences allowed him to acknowledge that the main characteristic of scientific activity as a process of historical discourse would be abolished; to recall Neurath's 'boat' metaphor, accepting a foundational approach (i.e. accepting an unquestionable authority of certain assumptions) would leave the sailors in the ship, responsible for its (endless) navigation at the sea, with no steering wheel for such a navigation.

Another crucial implication that can be gathered from Neurath's approach is that the Vienna Circle's demarcation of meaningful (scientific) and meaningless (metaphysical) propositions implemented through the principle of verifiability is untenable[107]. From the example of Neurath's holist approach, it can be inferred that not every single proposition possesses concrete reference to empirical data; in this

[106] If one takes on account that the activities of the members of the Vienna Circle were performed in the background of escalation of Nazism in Europe, Neurath's background in politics allowed Neurath to construct a comprehensive position on how authority is consequential not only for scientific inquiry, but also in all planes of human life.

[107] As one can recall the examination of the chapter 2, this line of argument was advocated by the foundationalist 'wing' of the Vienna Circle, supported namely by Schlick, Waismann and Feigl.

respect the correspondence theory of truth cannot be productively incorporated as an explanation of the reliability of scientific knowledge. Neurath's non-foundational approach, which displays scientific activity as a continuously evolving historical process, implies a much wider methodological range of tools to comprehend scientific activity in a much more accurate and delicate manner. This range is wider than, for instance, that of Quine's naturalistic theory of knowledge, since Neurath stressed the significance of socio-economic and political factors as influential for the course of scientific development.

With all this in hand, it can be concluded that, contrary to the accepted evaluation of the Vienna Circle, Neurath's position should be acknowledged as an important contribution to the innovative approach of this remarkable movement. In the light of the questions addressed at the beginning of this dissertation[108], Neurath's approach appears as the most fruitful and effective, since Neurath's physicalist position based on the non-foundationalist framework allows to understand how scientific knowledge can bear reliability, but at the same time is authorized to reshape and transform the bearers of knowledge in accordance with the scope of (developing) inquiry. In other terms, Neurath's approach is promising for the contemporary philosophy of science as the position of adjustable rationality provides one with understanding that is the closest to the actual scientific activity.

However, the tension between Neurath's (holist) conventionalism and anti-metaphysical attitude appears to threaten empiricist understanding of science. As it was already specified in the previous chapters, Neurath advocated for the coherent totality of (currently) accepted scientific statements, expressed in the physicalistic language, as the only appropriate account of scientific knowledge. The range of

[108] These questions can be reformulated as the following: how can one establish a comprehensive account of scientific activity? How can one claim for the reliability of scientific knowledge, if the process of change of one accepted scientific framework by another, more successful alternative, is inescapable? Are there any tools or methods that can help to maintain rationality in science notwithstanding the process of theory-change?

statements, incorporated in this totality, varied from the most basic observational level of protocols to the level of the most abstract theoretical hypotheses and law-like generalizations, formulated and accommodated by scientists in the course of their work. In addition, Neurath maintained that not every term incorporated in the totality of accepted scientific statements could be strictly reduced to the basic empirical (protocol) level[109]; hence the role of conventional agreements among scientists for the utilization of certain vocabulary as 'scientific' became essential. In this context, Neurath's acknowledgement of the fact that certain elements of scientific inquiry are conventional (i.e. not directly verifiable by experience) does not agree with his stressing that no untestable (metaphysical) constituents should be accepted in the totality of scientific statements. From a more general perspective, Neurath's anti-foundationalist (anti-authoritative, or anti-metaphysical) attitude towards scientific activity and his emphasis on the underlying value of agreements and decisions among scientists as one of the most essential features in the construction of rationality of scientific knowledge overlooks the empirical aspect of scientific inquiry, which one tries to preserve if s/he attempts to maintain an empiricist position. In accordance with Neurath's approach, one has to trust scientists in that all their efforts of interpreting phenomena are directed towards a more precise, more comprehensive and more valuable scientific representation. In this respect, one knows *for sure* that as long as the ship of science stays afloat in the variety of theoretical routes, it will take its best 'bet' at intersubjective rationality. Still, one will never know for sure whether the chosen route is the right one, or the most adequate one. In such a context, it will not be unreasonable to ask: if one will unquestionably accept Neurath's approach, to what extent will s/he stay confident in his/her belief that scientists form and operate with an adequate totality of statements, appropriately navigated by experience, instead of simply serving a

[109] Remember Neurath's remark on *Ballungen*, or imprecise terms that are used by scientists in science, such as the terms of ordinary language. For that reason, Neurath qualified the language of science as a universal "jargon".

pseudo-reliable fairy-tale, which complies well with their conventional basis[110]? Viewing from this angle, one can understand why Elie Zahar, in his book *Why Science Needs Metaphysics* (2007), a contemporary work on defending structural realism, accuses Neurath for proposing an extremely relativistic, and thus unreliable position, not only concerning basic empirical reports (protocols), but also mathematics and theoretical science in general [Zahar, 2007: 34].

It should be remarked that by pointing to the problematic aspects of Neurath's approach, one should not imply that the efforts put to rediscover Neurath's fruitful position should be neglected in favour of a structural realist (or any other) account of scientific activity. The goal of this dissertation was to establish an adequate, practically applicable and reliable way of comprehending the process of scientific inquiry; at the same time, the aim was to correlate all these features in a non-restricting manner in order to cover the process of theory-change as efficiently as possible. It is still maintained that the promising characteristics of Neurath's approach, described in the previous chapters, suit this goal the best. Rather, the issue specified in the above paragraph points to the fact that certain readjustments are necessary to avoid misleading evaluations of Neurath's attitude as relativistic, subjective and hence untenable. In what direction, then, can be these readjustments performed?

In order to accomplish any improvement on Neurath's account, one should firstly acknowledge that certain assumptions and principles, incorporated by scientists, do have the status of 'metaphysical'[111]. In particular, certain empirically untestable assertions are articulated in the process of scientific inquiry as heuristic guidelines that in turn help to promote the overall predictive and explanatory success of a theory. James Ladyman, in his article *Science, Metaphysics and Method* (2012),

[110] Particularly, Popper (2002) criticizes Neurath's approach from that aspect.

[111] The term 'metaphysical' is defined here as 'not directly verifiable by means of experience'. When confronted with the term in the text, the reader should refer mainly to this definition of the term.

describes a number of examples from the history of physics that aid to demonstrate the heuristic value of metaphysics in science. For example, Ladyman mentions the principle of the conservation of energy, or the theory of atomism, which he characterizes as follows:

> *Atomism* - the idea that all matter is composed of tiny particles and that their dynamical and structural properties might give rise to the apparent properties of everyday material objects such as their colours and textures was first articulated as purely metaphysical speculation with no observational implications, but of course it led to chemical atoms, the kinetic theory of gases and ultimately to the sub-atomic world. [Ladyman, 2012: 47].

Apart from examples provided by Ladyman, another example from the history of optics[112] can be provided to demonstrate how metaphysical assumptions are utilized in the process of scientific activity. The wave theory of light, which had championed its rival, the corpuscular theory, in the nineteenth century, was formulated by the contributions of many scientists, such as Thomas Young (1773-1829), Augustine Fresnel (1788-1827), François Arago (1786-1853), James Clerk Maxwell (1831-1879) and others. However, the development of the wave theory was initiated long before the great accomplishments of these scientists, at the time when physicists began to conjecture, *by analogy*, that light could propagate in patterns resembling those of sound waves. Particularly, such a presupposition was advocated by Christiaan Huygens (1629-1695), who formulated Huygens's principle, which further helped Fresnel to articulate his account of diffraction, and by Leonhard Euler (1707-1783), whose definition of light as vibrations of ether (analogical to sound as vibrations of air) aided Young to develop his theory of the interference of light. It is remarkable how the analogy between light and sound, being a purely conjectural, untestable 'tool' of discovery, allowed scientists to

[112] The development of the wave theory of light at the beginning of the nineteenth century was investigated in my MA thesis (2013). For the details of the history of optics mentioned in the paragraph, see Whittaker, E.T. (1951), *A History of the Theories of Aether and Electricity. The Classical Theories*, London: Thomas Nelson. For the original manuscripts of Huygens, Young and Fresnel, see Crew, H. (1900), *The Wave Theory of Light: Memoirs of Huygens, Young, and Fresnel*, New York: American Book Company.

establish a successful scientific framework. In other words, it can be inferred that the metaphysical assumption of resemblance between light and sound turned out to be heuristically valuable for the wave theory of light. Thus, one should admit the fact that the process of scientific activity is not hostile to incorporating metaphysical assumptions, if these assumptions help to enhance the predictive and explanatory power of a theory.

Lastly, it should be noted that the metaphysical aspect of conventions, which is vital for Neurath's approach, can be also mentioned as an example of the heuristic implication of metaphysics in science. One can infer that scientists' *decision* to assign a certain meaning to a theoretical term, navigated by the maximization of empirical resultativity of that designation, is not a procedure that can be easily tested by experience. For instance, whether physicists agree, by convention, to identify the term 'light' with the 'electro-magnetic wave' or with the 'stream of photons', or with the phenomenon 'which exhibits wave-particle duality' may be motivated by their considerations of simplicity, greater unity and greater productivity (i.e. the enhancement of predictive content of a theory), but none of these considerations are by themselves grounded in experience. It can be concluded that the process of conventional acceptance of theoretical terms and hypotheses, which facilitate the systematization and appropriate operation of the whole totality of statements, involves incorporation of metaphysical components. At the same time, it should not be inferred that the utilization of these components interferes with the process of establishing a reliable framework of scientific knowledge.

If one accepts that certain metaphysical assumptions are involved in the process of scientific activity, how can this aspect be incorporated within the scope of Neurath's approach, not sacrificing its non-foundationalist understanding of science as a historical discourse, while preserving (a general) empiricist position? A fruitful opportunity may lie in the reformulation of the Vienna Circle's principle of verifiability combined with a particular understanding of Neurath's protocol

sentences. In order to specify this opportunity in detail, let one firstly refresh the original formulations of verifiability and Neurath's protocols:

(1) The principle of verifiability: the meaning of a proposition is the method of its verification [Schlick, 1981a: 34].

(2) A protocol sentence: Otto's protocol at 3:17 o'clock: [Otto's speech-thinking at 3:16 o'clock was: (at 3:15 there was a table in the room perceived by Otto)] [Neurath, 1932/1983: 93].

Concerning the Vienna Circle's understanding of verifiability, taking on account the fact that certain (unverifiable) metaphysical assertions are actually utilized by scientists in the way specified above demonstrates the ineffectiveness of the original formulation. In this respect, the demarcation between meaningful (scientific) and meaningless (metaphysical) propositions implemented through the original principle of verifiability is untenable. Thus, it should be concluded that the necessity relation between meaning and verification should be broken down. If the aim of scientists is to articulate a comprehensive theoretical account of certain phenomena, motivated mainly by the achievement of predictive and empirical success, which is expressed by the amount of verifiable content, and if the accomplishment of this aim requires the application of certain metaphysical components, pronouncing all metaphysical statements as 'meaningless' will merely take one away from the adequate understanding of scientific activity.

How, then, can one maintain a promising understanding of verifiability? Such an understanding can be achieved through the following: instead of rooting the process of verification in the concept of meaning, it can be redirected to function as the tool for asking concrete, specific questions for the sake of maximizing the predictive content of a theory. It will be much more efficient if the principle of verifiability will aid a scientist to formulate his/her questions in the form 'x+2=6', than trying to seek a possible answer to 'x+y=6'. In this respect, Neurath's account of protocol statements, represented in the example (2) above, can serve as a principal contributor for the reconceptualization of verifiability. If Neurath's protocols are

evaluated as singular propositions, or "propositions that are about a particular individual in virtue of having that individual as a direct constituent" (Fitch and Nelson, 2018), they can be unquestionably verified by means of intersubjective test[113], and in turn can facilitate the process of further inquiry by providing a reliable basis[114] for all theoretical constituents of that inquiry. As a result, a scientist will be able to operate with his/her theoretical conjectures within the specific empirical framework, which will be interpreted as 'fixed' by the process of verification. Consequently, a philosopher of science will gain an opportunity to defend a non-foundationalist approach of adjustable rationality of scientific knowledge, at the same time allowing for untestable (metaphysical) components and preserving the reliance on its (underlying) empirical aspect[115]. Moreover, treating protocol statements as 'singular' will enhance the utility of the reformulated verifiability, since such understanding of protocols does not involve the problem of induction[116], and, by the same token, helps to minimize the risk of underdetermination of a theory by empirical data, built by means of singular protocols.

An example from the history of optics will serve to clarify how the readjusted principle of verifiability may help scientists in asking specific questions and thus effectively navigate the course of their inquiry. In the seventeenth century optics, the corpuscular theory of light, developed by Isaac Newton, prevailed as the well-

[113] As one can remember from the chapter 3 and 4, Neurath proposed a particular format of protocolling empirical datum in order to 'guarantee' its reliability through the process of test by other subjects.

[114] Here, it is not suggested that protocol statements should be accepted as incorrigible foundations of scientific knowledge. One should rather consider protocols as 'tools' that help to narrow down, or specify the course inquiry.

[115] In such a way, the basic tenet of empiricism that all knowledge comes from experience can be defended within the scope of Neurath's approach, avoiding relativist or subjectivist accusations.

[116] In general terms, the problem of induction states that no matter how many particular objects with similar properties are observed and thus combined in a generalization, such a generalization will never be fully reliable, since a single contrary evidence will refute the generalization. For instance, the general statement "All swans are white" can be refuted by the single observation of a black swan. Singular statements are not vulnerable to the problem of induction simply because the procedure of universal instantiation is not applicable to singular statements.

established theoretical framework. Basically, it defined light as the stream of tiny particles – corpuscles, which emanated from the source of light. By means of this basic assumption, various optical phenomena, such as reflection and refraction of light in a different media were explained. However, after Francesco Grimaldi (1618-1663) described the phenomenon of diffraction, or dark and light fringes appearing on observation screen when light was passing through a tiny slit, the corpuscular theory was faced with explanatory difficulty, since in accordance with its basic assumption, the particles emanating from the source should have formed the brightest spot at the centre of observational screen with no fringes whatsoever. Fresnel, a young French scientist, inspired by the newly developing hypothesis on the wave nature of light (which was born through the analogy between light and sound), started to work on the possible explanation based on that hypothesis. Let one assume that he had in hand an empirical datum, written in the form of a singular protocol statement:

> (2') Fresnel's protocol at 1:03 o'clock: [Fresnel's speech thinking at 1:02 o'clock was: (at 1:01 o'clock, the source of light was placed at *m* centimetres from the opaque object with a tiny slit at the centre; while light was passing through the tiny slit, *n* number of dark and light fringes at the observational screen was perceived by Fresnel)].

With such a directly and clearly verifiable statement in hand, Fresnel proceeded to articulate his explanation of diffraction. He acknowledged that in order to construct a successful explanation, it should comply with the protocol he started with. He continued his work; his first attempt was unsuccessful since the results obtained by theoretical calculations did not coincide with the given empirical results. In his second attempt, he conjectured to incorporate Huygens's principle; on order to do so, Fresnel developed a system of integrals that helped to obtain precise theoretical calculations, which in turn complied not only with existing experimental results, but were able to predict the fringe pattern for any value of '*m*' and '*n*' with high degree of accuracy. Fresnel managed to establish an account of diffraction, the

reliability of which was expressed in its predictive and explanatory success[117]. In general terms, this example demonstrates how reference to singular, easily verifiable observational statements through the process of inquiry can help to navigate scientist's efforts in addressing specific questions (in accordance with verified results) and in further formulating appropriate answers within the narrowed-down context.

While proposing such a readjustment of the principle of verifiability, it is in no way to suggest that it should be accepted as the principle underlying to any scientific inquiry. As was specified earlier, metaphysical assumptions and principles can have a heuristic value for scientific activity; however, it should not be concluded that such assumptions and principles are unalterable warrants of reliability of scientific knowledge, or that Neurath's approach may be modified only by means of this particular understanding of verifiability. Specifically, one should always have in mind that placing any assumption in the status of authoritative, or unquestionable principle will completely destroy the delicate balance between Neurath's anti-foundationalism and science as the only source of reliable knowledge, so no proposal for modification should be performed in that direction. Thus, metaphysics can be incorporated in science, but only in the following context:

> …metaphysical ideas are not only meaningful, but necessary in science. They provide an indispensable framework within which specific scientific theories can be constructed and compared with experience. Metaphysics acts as a guide, or heuristic, for science. But while a metaphysical guide is necessary to move in any direction at all, such a guide can just as easily lead in the wrong, as in the right, direction. […] What this shows is that there is no magic formula for doing good science. It is often necessary in scientific research to explore false trails so that the correct one can be found [Gillies, 1993: 201].

[117] Here, Fresnel's work on diffraction is adapted in order to exemplify how the proposed alternative of verifiability can be applied to an actual case from scientific practice, as it was examined in Kulandina, (2013). For Fresnel's original memoir on diffraction, see Crew, H. (1900), *The Wave Theory of Light: Memoirs of Huygens, Young, and Fresnel*. New York: American Book Company.

Lastly, it should be remarked that Neurath's stressing the importance of social, economical and political factors as contributory to the process of scientific activity, as it was noted in the chapter 4, should not be forgotten. One should recognize that, following Neurath's heritage, not only factors internal to scientific inquiry, but also external aspects of scientific activity, such as the general socio-political situation of a country, the accessibility of funds and of experimental tools, personal ambitions and motivations of a scientist, and many others can affect the navigation of the ship called 'science'. Nevertheless, the ultimate goal of the sailors of this ship will unchangeably be to stay afloat at the sea of endless discovery.

REFERENCES

Ayer, A. J. (1959). Editor's Introduction. In A. J. Ayer (ed.), *Logical Positivism* (pp. 3-28). New York: The Free Press.

Berkovski, S. (2019). Some Remarks on Mach's Philosophical Doctrines. In F. Stadler (ed.), *Ernst Mach: Life, Work and Influence* (pp. 1-10). Cham: Springer International Publishing.

Blumberg, A. E., & Feigl, H. (1931). Logical Positivism. *The Journal of Philosophy, 28*(11), 281-296.

Carnap, R. (1934/1981). Protocol Statements and the Formal Mode of Speech. In O. Hanfling (ed.), *Essential Readings in Logical Positivism* (pp. 150-160). Oxford: Basil Blackwell.

Carnap, R. (1959). The Elimination of Metaphysics through Logical Analysis of Language. In A. J. Ayer (ed.), *Logical Positivism* (pp. 60-81). New York: The Free Press.

Cartwright, N., & Uebel, T. E. (1996). Philosophy in the Earthly Plane. In E. Nemeth, & F. Stadler (eds.), *Encyclopedia and Utopia: The Life and Work of Otto Neurath* (pp. 39-52). Dordrecht: Kluwer Academic Publishers.

Cartwright, N., Cat, J., Fleck, L., & Uebel, T. (1996). *Otto Neurath: Philosophy between Science and Politics.* Cambridge: Cambridge University Press.

Cassirer, E. (1996). On the Theory of the Formation of Concepts. In S. Sarkar (ed.), *The Emergence of Logical Empiricism: from 1900 to the Vienna Circle* (pp. 179-202). New York: Garland Publishing Inc.

Creath, R. (2007). Vienna, the City of Quine's Dreams. In A. Richardson, & T. Uebel (eds.), *The Cambridge Companion to Logical Empiricism* (pp. 332-345). New York: Cambridge University Press.

Creath, R. (2014). (Anti-)Metaphysics in the Thirties: And Why Should Anyone Care Now? In M. C. Galavotti, E. Nemeth, & F. Stadler (eds.), *European Philosophy of Science - Philosophy of Science in Europe and the Viennese Heritage* (pp. 67-76). Cham: Springer International Publishing.

Duhem, P. (1954). *The Aim and Structure of Physical Theory.* Princeton: Princeton University Press.

Dvorak, J. (1991). Otto Neurath and Adult Education: Unity of Science, Materialism and Comprehensive Enlightenment. In T. E. Uebel (ed.), *Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle* (pp. 265-274). Dordrecht: Kluwer Academic Publishers.

Einstein, A. (1996). Geometry and Experience. In S. Sarkar (ed.), *The Emergence of Logical Empiricism: from 1900 to the Vienna Circle* (pp. 97-126). New York: Garland Publishing Inc.

Feigl, H. (1969). The Origin and Spirit of Logical Positivism. In P. Achinstein, & S. F. Barker (eds.), *The Legacy of Logical Positivism: Studies in the Philosophy of Science* (pp. 3-25). Baltimore: The John Hopkins Press.

Fitch, G., & Nelson, M. (2018, March 21). *Singular Propositions*. Retrieved from The Stanford Encyclopedia of Philosophy: <https://plato.stanford.edu/archives/spr2018/entries/propositions-singular/>

Frank, P. (1948). The Place of Logic and Metaphysics in the Advancement of Modern Science. *Philosophy of Science, 15*(4), 275-286.

Frank, P. (1955a). Introduction - Historical Background. In P. Frank, *Modern Science and Its Philosophy* (pp. 1-52). New York: George Braziller.

Frank, P. (1955b). The Importance for Our Times of Ernst Mach's Philosophy of Science. In P. Frank, *Modern Science and Its Philosophy* (pp. 61-78). New York: George Braziller.

Frank, P. (1955c). Ernst Mach and the Unity of Science. In P. Frank, *Modern Science and Its Philosophy* (pp. 79-89). New York: George Braziller.

Friedman, M. (1999). *Reconsidering Logical Positivism.* Cambridge: Cambridge University Press.

Gillies, D. (1993). *Philosophy of Science in the Twentieth Century: Four Central Themes.* Oxford: Blackwell.

Gower, B. (2000). Cassirer, Schlick and 'Structural' Realism: the Philosophy of the Exact Sciences in the Background to Early Logical Empiricism. *British Journal for the History of Philosophy, 8*(1), 71 - 106.

Hahn, H. (1980). The Significance of the Scientific World View, Especially for Mathematics and Physics. In H. Hahn, *Empiricism, Logic and Mathematics* (pp. 20-30). Dordrecht: Reidel Publishing Company.

Haller, R. (1985/1991). The First Vienna Circle. In T. E. Uebel (ed.), *Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle* (pp. 95-108). Dordrecht: Kluwer Academic Publishers.

Haller, R. (1986/1991). On the Historiography of Austrian Philosophy. In T. E. Uebel (ed.), *Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle* (pp. 41-51). Dordrecht: Kluwer Academic Publishers.

Haller, R. (1991a). On Otto Neurath. In T. E. Uebel (ed.), *Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle* (pp. 25-31). Dordrecht: Kluwer Academic Publishers.

Haller, R. (1991b). History and the System of Science in Otto Neurath. In T. E. Uebel (ed.), *Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle* (pp. 33-40). Dordrecht: Kluwer Academic Publishers.

Haller, R. (1996). Otto Neurath - For and Against. In E. Nemeth, & F. Stadler (eds.), *Encyclopedia and Utopia: The Life and Work of Otto Neurath* (pp. 29-38). Dordrecht: Kluwer Academic Publishers.

Hanfling, O. (1981). Introduction. In O. Hanfling (ed.), *Essential Readings in Logical Positivism* (pp. 1-25). Oxford: Basil Blackwell.

Hegselmann, R. (1987). Unified Science: The Positive Pole of Logical Empiricism. In B. McGuinness (ed.), *Unified Science* (pp. 1-23). Dordrecht: Reidel Publishing Co.

Hilbert, D. (1927/1996). The Foundations of Mathematics. In S. Sarkar (ed.), *The Emergence of Logical Empiricism: from 1900 to the Vienna Circle* (pp. 228-243). New York: Garland Publishing Inc.

Kant, I. (1784/2006). An Answer to the Question: What is Enlightenment? In I. Kant, *Toward Perpetual Peace, and Other Writings on Politics, Peace, and History* (pp. 17-23). Binghamton: Vail-Ballou Press.

Kant, I. (1929). *Critique of Pure Reason.* (N. K. Smith, Trans.) Hampshire: Palgrave Macmillan.

Kraft, V. (1953). *The Vienna Circle: the Origin of Neo-positivism.* (A. Pap, Trans.) New York: Philosophical Library, Inc.

Kulandina, Y. (2013). *Young and Fresnel: A Case-study Investigating the Progress of the Wave Theory in the Beginning of the Nineteenth Century in the Light of its Implications to the History and Methodology of Science* (unpublished master's thesis). Middle East Technical University, Ankara, Turkey.

Ladyman, J. (2012). Science, Metaphysics and Method. *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition, 160*(1), 31-51.

Mach, E. (1882/2014). On the Economical Nature of Physical Inquiry. In E. Mach, *Popular Scientific Lectures* (pp. 186-213). Cambridge: Cambridge University Press.

Mach, E. (1883/2014). On Transformation and Adaptation in Scientific Thought. In E. Mach, *Popular Scientific Lectures* (pp. 214-235). Cambridge: Cambridge University Press.

Mach, E. (1890). The Analysis of the Sensations. Antimetaphysical. *The Monist, 1*(1), 48-68.

Mach, E. (1893/1960). The Economy of Science. In E. Mach, *The Science of Mechanics: A Critical and Historical Account of its Development* (pp. 577-595). La Salle: The Open Court Publishing Company.

Mach, E. (1893/1960). The Relations of Mechanics to Other Departments of Knowledge. In E. Mach, *The Science of Mechanics: A Critical and Historical Account of its Development* (pp. 596-615). La Salle: The Open Court Publishing Company.

Mach, E. (1893/1960). Theological, Animistic, and Mystical Points of View in Mechanics. In E. Mach, *The Science of Mechanics: A Critical and Historical Account of its Development* (pp. 541-560). La Salle: The Open Court Publishing Company.

Mach, E. (1894/2014). On the Principle of Comparison in Physics. In E. Mach, *Popular Scientific Lectures* (pp. 236-258). Cambridge: Cambridge University Press.

Mayhall, C. W. (2003). *On Logical Positivism.* Belmont: Wadsworth/Thomson Learning.

Menger, C. (1960). Introduction to the Sixth American Edition. In E. Mach, *The Science of Mechanics: A Critical and Historical Account of its Development* (pp. v-xxi). La Salle: The Open Court Publishing Company.

Menger, K. (1980). Introduction. In H. Hahn, *Empiricism, Logic and Mathematics* (pp. ix-xviii). Dordrecht: Reidel Publishing Company.

Morganti, M. (2013a). Metaphysics and Science. In M. Morganti, *Combining Science and Metaphysics: Contemporary Physics, Conceptual Revision and Common Sense* (pp. 1-28). New York: Palgrave Macmillan.

Neurath, O. (1913a/1983). The Lost Wanderers of Descartes and the Auxiliary Motive. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 1-12). Dordrecht: Reidel Publishing Company.

Neurath, O. (1913b/1996). The Problems of War Economics (a small selection in English). Originally published as Probleme der Kriegswirtschaftslehre. In N. Cartwright, J. Cat, L. Fleck, & T. E. Uebel, *Otto Neurath: Philosophy between Science and Politics* (pp. 130-1). Cambridge: Cambridge University Press.

Neurath, O. (1921/1973). Anti-Spengler. In O. Neurath, *Empricism and Sociology* (pp. 158-213). Dordrecht: Reidel Publishing Company.

Neurath, O. (1928/1973). Personal Life and Class Struggle . In O. Neurath, *Sociology and Empiricism* (pp. 249-297). Dordrecht: Reidel Publishing Company.

Neurath, O. (1930/1983). Ways of Scientific World Conception. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 32-47). Dordrecht: Reidel Publishing Company.

Neurath, O. (1931a/1983). Physicalism: The Philosophy of the Viennese Circle. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 48-51). Dordrecht: Reidel Publishing Company.

Neurath, O. (1931b/1983). Physicalism. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 52-57). Dordrecht: Reidel Publishing Company.

Neurath, O. (1931d/1983). Sociology in the Framework of Physicalism. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 58-90). Dordrecht: Reidel Publishing Company.

Neurath, O. (1932/1983). Protocol Statements. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 91-99). Dordrecht: Reidel Publishing Company.

Neurath, O. (1933/1987). Unified Science and Psychology. In B. McGuinness, *Unified Science* (pp. 1-23). Dordrecht: Reidel Publishing Company.

Neurath, O. (1934/1983). Radical Physicalism and the 'Real World'. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 100-114). Dordrecht: Reidel Publishing Company.

Neurath, O. (1935a/1983). The Unity of Science as a Task. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 115-120). Dordrecht: Reidel Publishing Company.

Neurath, O. (1935b/1983). Pseudorationalism of Falsification. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 121-131). Dordrecht: Reidel Publishing Company.

Neurath, O. (1936/1983). Individual Sciences, Unified Science, Pseudorationalism. In O. Neurath, *Philosophical Papers: 1913-1946* (pp. 132-138). Dordrecht: Reidel Publishing Company.

Neurath, O. (1959). Sociology and Physicalism. In A. J. Ayer (Ed.), *Logical Positivism* (pp. 282-317). New York: The Free Press.

Neurath, O. (1973). *Empricism and Sociology.* (M. Neurath, & R. S. Cohen, Eds.) Dordrecht: Reidel Publishing Co.

Neurath, O., Carnap, R., & Hahn, H. (1973). The Scientific Conception of the World: The Vienna Circle. In O. Neurath, *Empiricism and Sociology* (pp. 299-318). Dordrecht: Reidel Publishing Company.

Neurath, P. (1996). Otto Neurath (1882-1945) - Life and Work. In E. Nemeth, & F. Stadler, *Encyclopedia and Utopia: The Life and Work of Otto Neurath* (pp. 15-28). Dordrecht: Kluwer Academic Publishers.

Outram, D. (2006). *Panorama of the Enlightenment.* Los-Angeles: Getty Publications.

Poincaré, H. (1921). Science and Hypothesis. In H. Poincaré, *The Foundations of Science* (pp. 9-197). New York: The Science Press.

Popper, K. (2002). Concerning the So-called 'Protocol Sentences'. In K. Popper, *The Logic of Scientific Discovery* (pp. 76-79). London and New York: Routledge Classics.

Quine, W. v. O. (1949). Truth by Convention. In H. Feigl, & W. Sellars (eds.), *Readings in Philosophical Analysis* (pp. 250-273). New York: Appleton Century Crofts Inc.

Quine, W. v. O. (1951). Main Trends in Recent Philosophy: Two Dogmas of Empiricism. *The Philosophical Review, 60*(1), 20-43.

Quine, W. v. O. (1957). The Scope and Language of Science. *The British Journal for the Philosophy of Science, 8*(29), 1-17.

Quine, W. v. O. (1969a). Epistemology Naturalized. In W. v. O. Quine, *Ontological Relativity and Other Essays* (pp. 69-90). New York: Columbia University Press.

Quine, W. v. O. (1969b). Natural Kinds. In W. v. O. Quine, *Ontological Relativity and Other Essays* (pp. 114-138). New York: Columbia University Press.

Quine, W. v. O. (1975). On Empirically Equivalent Systems of the World. *Erkenntnis, 9*(3), 313-328.

Quine, W. v. O. (2013). Translation and Meaning. In W. v. O. Quine, *Word and Object* (pp. 23-41). Cambridge, Massachusetts: The MIT Press.

Quine, W. v. O., & Ullian, J. (1978). *The Web of Belief.* New York: Random House Inc.

Raatikainen, P. (2018). *Gödel's Incompleteness Theorems*. Retrieved from The Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/archives/sum2018/entries/goedel-incompleteness/

Russell, B. (1924/1996). Logical Atomism. In S. Sarkar (ed.), *The Emergence of Logical Positivism: from 1900 to the Vienna Circle* (pp. 203-227). New York: Garland Publishing Inc.

Schlick, M. (1981a). Meaning and Verification. In O. Hanfling (ed.), *Essential Readings in Logical Positivism* (pp. 32-43). Oxford: Basil Blackwell.

Schlick, M. (1981b). On the Foundation of Knowledge. In O. Hanfling (ed.), *Essential Readings in Logical Positivism* (pp. 178-196). Oxford: Basil Blackwell Publisher Limited.

Soames, S. (2003). *Philosophical Analysis in the Twentieth Century, Volume 1: The Dawn of Analysis,* (pp. 257-299). New Jersey: Princeton University Press.

Stadler, F. (2001). *The Vienna Circle: Studies in the Origins, Development, and Influence of Logical Empiricism.* Vienna: Springer.

Stadler, F. (2007). The Vienna Circle: Context, Profile and Development. In A. Richardson, & T. E. Uebel (eds.), *The Cambridge Companion to Logical Empiricism* (pp. 13-40). New York: Cambridge University Press.

Uebel, T. E. (1991). Otto Neurath and the Neurath Reception: Puzzle and Promise. In T. E. Uebel (ed.), *Rediscovering the Forgotten Vienna Circle: Austrian Studies on Otto Neurath and the Vienna Circle* (pp. 3-22). Dordrecht: Kluwer Academic Publishers.

Uebel, T. E. (1992). Introduction: Otto Neurath, the Vienna Circle and the Protocol Sentences Debate. In T. E. Uebel, *Overcoming Logical Positivism From Within* (pp. 1-28). Amsterdam: Rodopi.

Uebel, T. E. (1993). Neurath's Protocol Statements: A Naturalistic Theory of Data and Pragmatic Theory of Theory Acceptance. *Philosophy of Science, 60*(4), 587-607.

Uebel, T. S. (1996a). Normativity and Convention: On the Constructivist Element of Neurath's Naturalism. In E. Nemeth, & F. Stadler (eds.), *Encyclopedia and Utopia: The Life and Work of Otto Neurath* (pp. 97-112). Dordrecht: Kluwer Academic Publishers.

Uebel, T. E. (1996b). The Enlightenment Ambition of Epistemic Utopianism: Otto Neurath's Theory of Science in Historical Perspective. In R. N. Giere, & A. W. Richardson (eds.), *Origins of Logical Empiricism: Minnesota Studies in the Philosophy of Science, XVI* (pp. 91-112). Minneapolis: University of Minnesota Press.

Uebel, T. E. (2008). Writing a Revolution: On the Production and Early Reception of the Vienna Circle's Manifesto. *Perspectives on Science, 16*(1), 70-102.

Uebel, T. E. (2014). *Vienna Circle*. Retrieved from Stanford Encyclopedia of Philosophy: http://plato.stanford.edu/archives/spr2014/entries/vienna-circle/

Waismann, F. (1981). Verification and Definition. In O. Hanfling (ed.), *Essential Readings in Logical Positivism* (pp. 27-32). Oxford: Basil Blackwell.

Wittgenstein, L. (2001). *Tractatus Logico-Philosophicus.* London and New York: Routledge Classics.

Zach, R. (2016). *Hilbert's Program*. Retrieved from The Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/archives/spr2016/entries/hilbert-program/

Zahar, E. (2007). How Respectable Is Metaphysics? In E. Zahar, *Why Science Needs Metaphysics: A Plea for Structural Realism* (pp. 1-3). Chicago and La Salle: Open Court Publishing Co.

Zahar, E. (2007). Protocol or Basic Statements? In E. Zahar, *Why Science Needs Metaphysics: A Plea for Structural Realism* (pp. 29-77). Chicago and La Salle: Open Court Publishing Co.

Zalta, E. N. (2018). *Gottlob Frege*. Retrieved from The Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/archives/sum2018/entries/frege/

APPENDICES

A. CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Kulandina, Yevgeniya
Nationality: Kazakhstan
Date and Place of Birth: 6 April 1987, Oskemen
Phone: +90 535 074 49 83
email: yevgeniya.kulandina@gmail.com

EDUCATION

Degree	Institution	Year of Graduation
PhD	METU Philosophy	2019
MA	METU Philosophy	2013
BA	METU Philosophy	2009
High School	Secondary School № 7, Oskemen	2004

AREAS OF SPECIALISATION Philosophy of science, methodology of science

AREAS OF COMPETENCE Metaphysics of science, epistemology

EXPERIENCE

2017	Project Assistant Scientific Activities, University, and Society: The Case Study of the Activities of the Department of Mathematics in METU (1956/59-1982). Project Manager: Assoc. Prof. Dr. Samet Bağçe
2017-2018	Writer, philosophical essays DüşünBil - Turkish monthly journal for the popularization of philosophy. For essays (in Turkish) see the following link: https://dusunbil.com/author/yevgeniya-kulandina/

NON-ACADEMIC INTERESTS Music, Cinema, Environmentalism

B. TURKISH SUMMARY / TÜRKÇE ÖZET

Viyana Çevresi (*Der Weiner Kreis*), yirminci yüzyıl felsefesinin en göze çarpan hareketlerinden biri olarak değerlendirilebilir. Bu tespitin gerekçelerine bakacak olursak Çevre'nin tanınmış üyelerinin çeşitli başarılarına ek olarak geleneksel felsefeye, ya da Viyana Çevresi'nin kendi deyimiyle, her türlü "anlamsız" ifadeye karşı olan 'radikal' duruşundan bahsedebiliriz. Alfred Whitehead ve Bertrand Russell'ın hazırladığı *Principia Mathematica* (1910-1913) aracılığıyla mantıkçılık (logicism) alanında yürütülen çalışmalar ve bunların Ludwig Wittgenstein tarafından 1922 senesinde *Tractatus Logico-Philosophicus* eserinde dil alanına da uygulanması felsefenin klasik deneyci tarihini dönüşüme uğratma iddiasındadır. Viyana Çevresi'nin hedefi her ne kadar yenilikçi ve taviz vermez derecede bilimsel bir görüşü dünyaya tanıtmak olsa da gerçekleştirilmeye çalışılan bu dönüşüm ileriki nesillerde hatırı sayılır bir etki yaratamamıştır. Felsefe tarihinin de gösterdiği üzere bu amaç için verilen çabalar günümüzde hak ettiği değeri görememekte ve bu katı bilimsel görüş bilim felsefesi içerisinde başat sayılmamaktadır. Bu etkisizliğe dair muhtemel bir açıklama, Viyana Çevresi'nin "standart" yorumu[118] ışığında elde edilebilir. Öte yandan güncel yaklaşımların[119] sağladığı alternatif bakış açısıyla daha kapsamlı bir materyal taraması yapılarak bu çevrenin felsefi görüşlerinin etkili olduğu daha genişçe bir alandaki çalışmaların keşfi de mümkündür. Böylesi bir araştırma bilim felsefesi ve yöntembilimindeki güncel meselelere dair kimi fikirler ortaya atarak onların çözümüne katkı sunabilir. Başka bir ifadeyle, Viyana Çevresi'nin taze bir bakış açısıyla yeniden değerlendirilmesi alan içerisindeki son derece önemli kimi sorulara cevap aramada bizlere yardımcı olabilir. Bunlar

[118] Standart yorumun kısıtları ilerleyen sayfalarda detaylı olarak açıklanacaktır.

[119] Bu değerlendirmeleri sunan felsefeciler arasında, Thomas Uebel (2008, 2014), Friedrich Stadler (2001, 2007) Rudolf Haller (1985, 1986) ve Michael Friedman (1999) bulunmaktadır.

arasında en kritik olanlar şu şekilde sıralanabilir: Bilimsel aktiviteyi açıklamayı amaçlayan genel bir değerlendirme yöntemi tasarlanabilir mi? Eğer böyle bir olanak varsa, bilimsel araştırmanın rasyonel niteliğini koruyabilmesi için bu yöntemin normatif olması şart mıdır? Normatif bir niteliği sahip olmadığı takdirde, bu yöntemin höristik yanlarından bahsetmek mümkün olacak mıdır? Eğer böyle bir durum söz konusu ise yöntemin höristiği neyden oluşacaktır? Çağdaş bir bilim felsefecisi en genel anlamıyla kendi değerlendirme yöntemine yardımcı olacak alet çantasını nasıl tanımlayacaktır? Bu aletler bilimsel aktivitenin güvenilirliğini hassas bir şekilde sağlayabilecek ya da bu etkinlik sırasında zaman zaman meydana gelen teori değişim sürecini kapsayabilecek midir?

Bu aşamada dikkat edilmesi gereken bir nokta, yukarıda belirtilen sorulara olası cevaplar bulmak konusunda yürütülecek bir analizin odak noktasında Viyana Çevresi'nin yer almasının bir rastlantı sonucu olmamasıdır. Daha önce bahsedildiği üzere Viyana Çevresi'nin en dikkat çekici argümanlarından biri metafiziğin reddi tezidir. Bu tez, yine aynı çevrenin doğrulanabilirlik prensibi tarafından desteklenmektedir. Genel bir ifadeyle Viyana Çevresi'nin doğrulanabilirlik anlayışı bilimsel araştırma içerisinde sadece anlamlı ifadelerin veya prensipte deneyim tarafından doğrulanabilen ifadelerin barındırılabilmesi olarak tanımlanabilir. Yukarıda yöneltilen sorular da bu çerçevede yanıtlanabilir. Okumakta olduğunuz doktora tez çalışması böylesi bir iddiaya sahiptir ve buna dayanak sunacak bir analizi ilerleyen satırlardaki sorular ışığında inşa etmeye çalışmaktadır. Viyana Çevresi'nin anlam ve doğrulanabilirlik kavramlarıyla ilişkilendirdiği metafiziğin reddi tezi, bilimsel araştırmanın anlaşılmasında etkili olabilir mi? Bunu metafiziksel herhangi bir varsayıma başvurmadan yapabilir mi? Eğer metafiziksel kavram ve prensiplerin kullanılmasının kaçınılmaz olduğu anlaşılırsa, bu tür metafiziksel varsayımlar bilimsel aktivitenin başarılı bir yöntembilimsel değerlendirmesi için ne derecede vazgeçilmez olacaktır? Deneyciliğin yapıtaşlarından biri olan doğrulanabilirlik prensibinin yöntembilimsel bir alet olarak yeniden tanımlanması için ne gerekmektedir? Ya da daha temelden bir soru olarak böyle bir olasılık var mıdır?

Yukarıda formüle edilen sorgulamayı gerçekleştirmek amacıyla, bu tez dört kısma ayrılmıştır. Birinci kısım (tezimde giriş bölümünü takiben Bölüm II olarak geçmektedir), Viyana Çevresi'nin yirminci yüzyılın başındaki bilimsel, felsefi ve sosyo-politik alt yapısına dair derinlikli bir inceleme sunmaktadır. Bu sunuş, Viyana Çevresi üyelerine atfedilen 'yenilikçi' duruşun gelişim sürecine ilham veren faktörleri anlamakta bizlere yardımcı olacaktır. Bu doğrultuda doğrulanabilirlik prensibi, metafizik kritik, protokol cümleler ve analitik/sentetik ayrım gibi Viyana Çevresi'ne ait tartışmalar ana hatlarıyla anlatılmaktadır. Bu detaylı açıklama, Viyana Çevresi'nin standart yorumunun tek taraflı oluşuna açıklık getirmekle beraber ve hatta bundan daha da önemli olarak hareketin çağdaş bilim felsefesi için verimli olabilecek mirasını gösterme niyetindedir. Bu mirasın oluşturulmasında önemli bir paya sahip olan Viyana Çevresi'nin başat üyeleri arasındaki Otto Neurath'ın hayatı ve çalışmaları tezimin ikinci kısmında incelenmektedir. Neurath'ın temelcilik karşıtı felsefi yaklaşımı ve bilimsel aktivitenin değerlendirilmesi konusunda takındığı fizikalist tutum detaylı biçimde anlatılmaktadır. Böylece bilimsel araştırma süresince bir bilim insanının karşılaşılabileceği herhangi bir metafiziksel terime, varsayıma veya prensibe karşı Neurath'ın sergileyeceği sert tutumun gerekçeleri gösterilmektedir. Tüm bunlara ek olarak tezin ilgili bölümünde, Neurath'ın 'açık denizdeki gemi' metaforu aracılığıyla sosyal, ekonomik ve politik faktörlerin bilimsel aktivitede önemli bir rol oynadığına değinilmektedir. Bununla amaçlanan ise bilimsel aktiviteyi kavrama süreci adına umut vadeden belli başlı yaklaşımların Neurath'ın kendi görüşü içerisinde var olduğu gerçeğinin açığa çıkarılmasıdır. Neurath özelinde Viyana Çevresi'nin bu mirası, tezin bir sonraki kısmında yapılan inceleme için temel alınmaktadır. Tezin üçüncü kısmında Neurath'ın felsefi mirası ile çağdaş bilim felsefesinin en başarılı düşünürlerinden biri olan Willard van Orman Quine'ın görüşündeki benzerliklere işaret eden ayrıntılı bir değerlendirme sunulmaktadır. Neurath'ın temelcilik karşıtı tutumu ve Quine'ın natüralist bakış açısı arasındaki benzerlik ve farklılıklar incelenerek tarafların birbirleri üzerinde bıraktığı olası etkiler tartışılmaktadır. Özellikle de Neurath'ın felsefi yaklaşımının hangi açılardan Quine'ın görüşüyle aynı verimliliğe sahip olduğuna ve hangi açılardan Quine'ın

görüşünü bu bağlamda aştığına dair yapılabilecek bir açıklamaya yardımcı olma amaçlanmaktadır. Bu bölümdeki inceleme, güncel ve duyarlı bir değerlendirme sunabilecek yetkin bir alet çantasını geliştirmeyi amaçlayan bilim felsefecileri için Neurath'ın pozisyonunun ne derece önemli olabileceğini göstermeyi hedeflemektedir. Son olarak, dördüncü kısım önceki bölümlerde yapılan analizi özetlemektedir. Bu bölümde, Viyana Çevresi hakkında yapılan standart yorumlamanın kısıtları açıklanmaktadır. Bu kısıtların belirlenmesindeki yararımız ise bahsi geçen çevrenin savunduğu pozisyonunun tek taraflı yorumu ile gösterilmesi mümkün olmayan bir işlevselliği ve çağdaş bilim felsefesine uygulanabilirliği gözler önüne sermektir. Bu doğrultuda da Neurath'ın yaklaşımının ne açıdan bir mirasa eş olduğu tüm çekici taraflarıyla belirtilmeye çalışılmaktadır. Tüm bunlara ek olarak, Neurath'ın felsefi pozisyonunda tespit edilen kimi kısıtları da (temelcilik karşıtı görüşü ve metafiziğin radikal biçimde reddi gibi) hesaba katarak, tezin son bölümü, metafiziksel varsayımların bilimsel gelişim sürecini nasıl şekillendirebildiğini ve nasıl birer höristiğe dönüştüğünü açıklamaktadır. Bu bağlamda, analizin başında yöneltilen sorular ışığında Neurath'ın yaklaşımına uygulanması muhtemel bir perspektif sunulmaktadır. Bu alternatif bakış açısı, Neurath'ın temelcilik karşıtı görüşüyle bir çelişki yaratmamakla beraber metafiziğin bilimdeki höristik rolüne müsaade etmektedir. Son olarak, bilimsel rasyonelliğe dair efektif ve aynı zamanda kısıtlamasız bir anlayışın ana kriterleri belirtilmekte olup bilimsel güvenilirlik tanımının çağdaş bir yorumu ileri sürülmektedir.

Tezdeki analize uygun olarak, aşağıda ayrıntılı şekilde açıklanan kimi sonuçlara varılmıştır. Her şeyden önce, Viyana Çevresi pozitivist yönelimlere sahip indirgemeci bir grup basitliğinde kesinlikle görülmemelidir. Diğer bir ifadeyle, Viyana Çevresi üyelerinin *hep bir ağızdan* bilimsel (anlamlı) ve metafiziksel (anlamsız) ifadeler arasında katı bir felsefi ayrımı amaçlayan dilbilimsel bir dönüşümü (linguistic turn) tercih ettiklerini düşünmek tutarlı değildir. Genellikle standart yorumun savunduğu bu anlayış, Viyana Çevresi'nin ortaya koyduğu felsefeyi yanlış tanımlamakta ve aynı zamanda bu mühim grup hakkında yürütülen

alternatif yorumlara ve bu doğrultuda ileri sürülen faydalı tahlillere ket vurmaktadır. Başka bir deyişle, Viyana Çevresi'nin standart yorumu, bu çevreye dair yapılabilecek efektif bir analiz ile keşfedilebilecek değerleri gölgelemektedir.

Tüm bunlar göz önünde tutulduğunda, Viyana Çevresi'ne dair getirilmeye çalışılan alternatif değerlendirme aşağıdaki hususlara açıklık kazandırmaktadır: nüfuzlu bilim adamlarını ve felsefecilerini bünyesinde kapsayarak bir araya getiren Viyana Çevresi, bu Çevre'yi takip eden nesillere çeşitli görüş ve yaklaşımlarını miras bırakmayı başarmıştır. Diğer bir ifadeyle, Viyana Çevresi'nin üyeleri tartışmalarına yön veren genel motivasyonda uyumlu olmalarına rağmen bağımsız duruşlarından taviz vermeyip kişisel olarak da özgün görüşler sunabilmişlerdir. Bir örnek olarak protokol cümlelere ele aldığımızda bazı üyelerin bu cümlelerin kendilerini dahi tartışmaya açık halde tutarak temelcilik karşıtı bir görüş savunduklarını (Neurath, Carnap ve Frank gibi), bazılarının ise bu cümleleri bilimsel aktivitenin birer yapıtaşı olarak kabul edip temelci bir görüşü desteklediklerini (Schlick ve Waismann gibi) görebiliriz. Bu bağlamda, Viyana Çevresi'nin temsil ettiği tek bir görüşten ziyade ev sahipliği yaptığı *görüşlerden* bahsetmek daha doğru olacaktır. Aksi halde, bu önemli grubun öncüllerinin verimliliği ve işlevselliği yeterince kapsanamamakta ve içerdiği zenginlik ön plana çıkarılamamaktadır. . Özellikle, Viyana Çevresi'nin öne sürdüğü kimi yeni kavramsallaştırmalar metafiziğe olan tutumları hakkında daha keskin bir anlayışı sahiplenmelerine yardımcı olmaktadır. Viyana Çevresi'ne dair yapılan standart yorumun iddia ettiğine göre, tüm üyeler metafiziğe karşıydı, yani analitik veya sentetik sınıflandırmasına girmeyen herhangi bir terim veya cümlenin bilimde yeri olmadığını savunuyorlardı. Fakat yaygın olarak inanılanın aksine Viyana Çevresi hakkında yazılan bu tezdeki incelemede, üyelerin metafiziği *tamamıyla* reddetmedikleri anlaşılmaktadır. Bu sebeple de Viyana Çevresi'nin felsefesine dair daha tutarlı bir tanımlama yapılacaksa üyelerin metafiziği değil metafiziğin bilim üzerindeki otoritesini kabul etmedikleri söylenmelidir. Üyeler, herhangi bir varsayımın, prensibin veya kavramın değişmez statüsünden; sorgulamaya ve test edilmeye kapalı olan tüm ifadelerden uzak durmaya çalışıyorlardı. Bu bağlamda, dini ve politik dogmaların bilimsel araştırmayı hiçbir

şart altında yönlendirmemeliydi çünkü bu tarz tartışılmaz dogmalar, Viyana Çevresi'nin yaklaşımına göre metafiziksel olarak nitelendirilmeli ve tamamen reddedilmeliydi. Orta Avrupa'da Nazizm'in güçlendiği sırada dahi Viyana Çevresi'nin faaliyetlerini sürdürdüğü gerçeği göz önüne alındığında , metafiziğe karşı şekillenen bu görüşler daha da önemli ve değerli bir hale geliyor. Kısacası, Viyana Çevresi'nin metafiziğe karşı olan tutumu zamanın politik alt yapısının zorunlu kıldığı bir hareketti.

Metafiziğin reddinin yanı sıra Viyana Çevresi'nin tüm üyelerinin genel hatlarıyla hem fikir oldukları bir nokta daha bulunuyor: metafizik, bağımsız bir bilgi kaynak olma hususunda kuşku barındırıyor. "Bilimsel dünya kavrayışı" ("Scientific World Conception") savunucuları olarak Viyana Çevresi'nin üyeleri, kapsamlı ve güvenilir bir bakış açısının yalnızca ve yalnızca bilimsel bir zemin üzerinde inşa edilebileceğine inanıyorlardı. Başka bir ifadeyle, böylesi geniş bir bakış açısının sadece ve sadece deneyim tarafından doğrulanabilir ifadelerden[120] oluşturulabileceğini savunuyorlardı. 'Tanrı'nın gücü sınırsızdır' veya 'Zaman ve mekân mutlaktır' gibi metafiziksel cümleler deneyim yoluyla doğrulanabilir olmadıkları için Viyana Çevresi bunun gibi ifadeleri "anlamsız" olarak nitelendiriyordu. Yine de bu nitelemeden Viyana Çevresi'nin metafiziği tamamıyla anlamsız bir araştırma alanı olarak gördüğü yorumunu çıkarmak abartılı olacaktır. Bu çıkarımdan ziyade, Viyana Çevresi üyelerinin metafiziği bilimsel bilgi veya *test edilebilir* bilgi alanın dışında gördüklerini belirtmek daha yerinde olacaktır:

> Metafiziksel ifadelerin "anlamsız" olarak nitelendirilmesinin uygun olmadığını düşünüyorum. Pek çok ifade, "metafiziksel" olmadığı halde anlamsızdır. […] Benim konuşma şeklime uygun olarak metafizik, bilimsel olandan hareketle bakıldığında elbette anlamsızdır, zira "doğru" veya "yanlış" şeklinde bir sınıflandırma bu gibi ifadelere uygulanamaz [Frank, 1948: 277-8, çeviri tez yazarına ait].

[120] Bu tezin ikinci kısmında açıklandığı gibi, Schlick ve Neurath bir ifadenin ne şekilde deneysel olarak veri olanın üzerinden doğrulanabilir olduğu konusunda ve 'gerçeklik' hakkındaki anlayışlarında farklı görüşleri savunuyorlardı. Bu ayrımlar tezin bu bölümünde ihmal edilmiyor. Aksine bu ve benzeri faktörler göz önünde bulundurulduğundan paragraf başında "genel hatlar" ifadesi kullanılmaktadır.

Frank dışında, diğer üyeler de Viyana Çevresi'nin tam olarak ne şekilde metafiziği reddettiğini kendi çalışmalarında belirtiyorlardı. Mesela Neurath, temelcilik karşıtı yaklaşımıyla üyeler arasında metafiziğe karşı en radikal tutumu sergilemesine rağmen, bazı metafiziksel varsayımların anlamsız (deneyim açısından doğrulanamaz) olmasıyla birlikte kaçınılmaz olduğunu da kabul ediyordu. Neurath'ın açıklamasına göre, kimi metafiziksel varsayımlar bilimsel ifadelerin daha geniş bir tahmin başarısını elde etmesi için "uyarıcı" işlevindeydiler[121] [Neurath, 1959: 300].

Viyana Çevresi tarafından savunulan metafiziğin reddi tezi, yalnızca anlamlı ve anlamsız ifadelerin ayrımını doğrulanabilirlik prensibi aracıyla sağlayabilmek için kullanılmamıştır. Aksine Viyana Çevresi'nin mirası daha kapsamlı bir şekilde şöyle özetlenebilir: o dönem bilimin birçok dalında gerçekleşen gelişmeler ışığında, bilimsel aktivitenin 'metafiziksel' (dogmatik) düşünme biçimlerinden arındırılarak yeniden kavramsallaştırmasına olanak sunmak ve bunu bilimsel pratiğin daha etkili bir biçimde değerlendirilebilmesi için yapmak. Viyana Çevresi içerisindeki görüş çeşitliliğine rağmen tüm üyeler, dogmatik, değişmez norm ve prensiplere duyulan gereksinimin bilimsel aktivitenin başarısına ve verimli şekilde analizine köstek olacağı konusunda ortaklaşıyorlardı . Aydınlanma hareketini takip eden Viyana Çevresi üyeleri, bilginin *mutlak* kaynağının bilimde bulunabileceğini öne sürmüşlerdir. Üyelerin arkasında durduğu bu tavır test edilemeyen (metafiziksel) tüm terimler, varsayımlar ve teorilere olan ihtiyacı reddediyordu. Özetlemek gerekirse, Viyana Çevresi'ni alternatif bir bakış açısıyla yeniden değerlendirilmesindeki amaç, üyeler arasındaki fikirsel çeşitliliğe rağmen, ya da daha doğru bir şekilde onlar sayesinde, ortaklaşa sahiplenilen "bilimsel dünya kavrayışı" ve bunu yaygınlaştırma çabasını ön plana çıkarmaktır. Diğer bir ifadeyle, Viyana Çevresi üyelerinin beraberce yürüttüğü metafiziğe karşı mücadele, aslında

[121] Frank ve Neurath dışında, Schlick (1981a) de metafiziğin mutlak bir bilgi kaynağı olamayacağını öne sürüyordu. Buna rağmen, Schlick'e göre metafiziğin temel amacı, dil üzerinden mantıksal bir analiz uygun kimi araçlar sunması ve bunlar aracılığıyla bilimsel ifadelerin düzenlenip koordine edilebilmesiydi.

güvenilir olduğunu iddia eden tüm kavrama faaliyetlerinin herhangi bir seviyesinde otoriteye karşı yapılan bir mücadeleydi. Viyana Çevresi'nin günümüze devrolan görüşleri düşünüldüğünde, bu hususa her şeyden önce dikkat çekilmelidir.

Viyana Çevresi'nin verimli mirasının önemli bir parçası da Neurath'tır. Kendisinin çevre içerisinde yürüttüğü faaliyetlere ve sağladığı faydalara değinmeyi bu bağlamda önemli görüyorum. İlk olarak işaret edilmesi gereken nokta, Neurath'ın tüm tartışmalara rağmen bilimsel pratik hakkında savunduğu temelcilik karşıtlığı, ekonomi, sosyoloji ve politikada edindiği tecrübelere dayanmaktadır. Otoriteye karşı yabancılaşmanın sonuçlarına dair bir analizin sonucudur. Bilimdeki bakış açısını bir ekonomist olarak ve sosyo-politik alandaki deneyiminden güç alarak geliştiren Neurath, herhangi bir terimin, fikrin veya tutumun tartışmaya ve değişime kapalı kabulünün getirdiği sıkıntıları daha canlı bir biçimde öngörebiliyordu[122]. Viyana Çevresi'nin üyeleri arasında bilimdeki temelciliğe karşı duruşu en sivri biçimde savunanın Neurath olmasındaki sebep, bu sosyo-politik deneyimden doğmaktadır. Neurath diğer üyelere göre daha da ayrıntılandırdığı temelcilik karşıtı görüşünde, bilgi ağının başlangıç noktasına herhangi değiştirilemez bir temelin konmasının bilimsel aktivitenin yenilikçi tarafını ve ilerleme esasını engelleyeceğine inanıyordu. Diğer bir deyişle, Neurath'ın otoriteye karşı yaklaşımı, kendisinin sosyal bilimlerdeki deneyimi sayesinde keskinleşmiştir. Bunun bir sonucu olarak da Neurath, bilimsel aktivitenin ana niteliğinin tarihsel söylem süreci ('a process of historical discourse') olduğuna inanmış ve bu kritik niteliğin herhangi bir otoritenin (temelin) varlığı söz konusu olduğunda ortadan kaldırılma tehlikesi ile karşı karşıya olduğunu savunmuştur.

Neurath'ın yaklaşımından çıkarabilecek bir diğer fikirsel miras da, Viyana Çevresi'nin anlamlı (bilimsel) ve anlamsız (metafiziksel) ifadeleri birbirinden

[122] Viyana Çevresi üyelerinin faaliyetlerini Avrupa'da Nazizm'in yükseldiği dönemde dahi sürdürdüğü göz önüne alındığında herhangi bir otoritenin yalnızca bilim alanında değil, insan hayatını ilgilendiren tüm alanlarda ne denli etkide bulunabileceğini anlayabiliyoruz. Neurath'ın politik tecrübelerinden de aynı kapsamlı sonuca varabilecek durumda olduğunu söyleyebiliriz.

ayırmak için faydalandığı doğrulanabilirlik prensibinin[123] Neurath'ın gözlemlediği şekliyle geçerli olmadığı tespitidir. Kendisinin öne sürdüğü bütünsellik (holist) görüşünden, her bir ifadenin doğrudan deneysel verilere referans veremeyebileceği rahatlıkla çıkarılabilir. Bu bağlamda, bilimsel bilginin güvenilirliğini sağlamak için 'doğruluğun uygunluk kuramı' (correspondence theory of truth) yeterli olmayacaktır. Bilimsel aktiviteyi sürekli evrimleşen bir tarihsel süreç olarak nitelendiren Neurath ve savunduğu temelcilik karşıtı duruş, bilimsel aktiviteyi başarılı ve mümkün olduğu kadar hassas bir biçimde değerlendirmek için çok daha geniş ve donanımlı bir yöntembilimsel alet çantası öne sürmektedir. Neurath'ın kapsamlı kullanım alanına sahip bu araçları bilimsel gelişimin açıklanmasında kullanılabilecek sosyo-ekonomik ve politik faktörleri de yöntemsel değerlendirmesine dâhil etmektedir. Tüm bunlar göz önüne alındığında , Neurath'ın alet çantasının Quine tarafından geliştiren natüralist bilgi teorisinden daha geniş olduğu tespitini yapmak mümkündür.

Yukarıda bahsi geçen analiz sonuçları kale alındığında, Viyana Çevresi hakkında kabul görmüş standart yoruma rağmen, Neurath'ın yaklaşımının bu önemli harekete sağladığı kritik katkılardan dolayı fark edilmesi ve hak ettiği takdiri görmesi gerekmektedir. Bu tezin başında yöneltilen sorular[124] ışığında, Neurath'ın yaklaşımının efektif ve verimli bir çözüme imkân sağladığı savunulabilir. Böylesi bir savunmadaki en önemli dayanak ise, Neurath tarafından geliştirilen ve temelcilik karşıtı zemine oturtulmuş fizikalist tutumdur. Bu görüş, bilimsel bilgiyi güvenilirlik niteliğini kaybetmeyen ama aynı zamanda açıklayıcı olduğu alanı mevcut bilimsel araştırma içerisinde genişletene ve dönüştüren bir süreç olarak tanımlayabilmektedir. Diğer bir ifadeyle, Neurath'ın bilimsel ilerlemeye dair

[123] Tezin ikinci kısmında detaylı olarak açıklandığı üzere, bu tarz bir doğrulanabilirlik prensibini Schlick, Waismann ve Feigl gibi Viyana Çevresi'nin temelciliği kabul eden 'kanadı' savunmuştu.

[124] Bu sorular şu şekilde tekrarlanabilir: bilimsel aktiviteye dair kapsamlı bir kavrayış ne şekilde oluşturulabilir? Bilim tarihinin ilgili kesiti içerisinde kabul edilmiş bir teorinin yapısı ileriki zamanlarda daha başarılı bir bilimsel teori tarafından değiştirilebiliyorsa, bilimsel güvenilirlik nasıl tanımlanabilir? Teori değişim sürecine rağmen bilimdeki rasyonelliğin tespit edilmesine yardımcı olacak araçlar veya yöntemler nasıl tanımlanabilir ve uygulanabilir?

yaklaşımı teoriler ve geliştirildiği tarihsel dönemler özelinde kalibre edilebilir bir rasyonelliğe sahip olduğundan ötürü pratikte yürütülen bilimsel aktiviteye çok yakın bir değerlendirme sunmaktadır. Bu sebeple de çağdaş bilim felsefesine son derece faydalı olma imkanına sahiptir.

Neurath'ın yaklaşımındaki olumluluklar kadar olumsuzluklara da değinmekte fayda görüyorum. Neurath'ın (konvansiyonalist) uzlaşımcılığı ve metafiziğe karşı olan tutumu arasındaki temassızlık, Viyana Çevresi'nin savunduğu görüşler arasında olan bilimin deneyci anlayışına bir kısıtlama getirebilir. Tezin üçüncü ve dördüncü kısımlarında ifade edildiği gibi Neurath, bilimsel bilginin tek geçerli açıklamasını fizikalist dilde yazılmış bilimsel cümlelerin tutarlı bütünlüğünde bulmaktaydı. Bu bütünlüğün içerisinde protokol cümleleri gibi somut gözlemlere dayanan ifadelerden genellemeler aracılığıyla erişilen soyut hipotezlere kadar farklı seviyelerde birçok bilgi içeren yapı yer almaktaydı. Neurath savunduğu bu çeşitlilikle tutarlı bir şekilde katı bir indirgemeciliği savunmuyordu. Ona göre hâlihazırda kabul edilen bilimsel ifadeler bütünündeki terimlerin her birinin protokol seviyesine indirgenmesi mümkün değildi[125]. Bu sebeple bilim adamları arasında yapılan konvansiyonel anlaşmalar ya da uzlaşımlar, muhtemel bir 'bilimsel terimler' sözlüğü oluşturmak hususunda son derece mühim rol oynuyordu. Ancak bu durum Neurath'ın iki görüşü arasında bir kopukluğa ya da başka bir deyişle temas eksikliğine yol açıyordu: bilimsel bir araştırmadaki kimi içeriklerin konvansiyonel olduğunun kabulü ve bilimsel ifadelerin bütününde deneyim yoluyla test edilemeyene (metafiziksel olana) kati karşıtlık. Daha genel bir perspektiften bakıldığında, Neurath'ın bilim konusundaki temelcilik karşıtı (diğer bir ifadeyle, otorite karşıtı veya metafizik karşıtı) görüşünü bilimsel ilerlemeye rasyonel kimliğini kazandıran uzlaşımcı görüşüyle bir arada düşündüğümüzde bilimsel kavrayıştaki deneyci taraf atlanıyormuş gibi gözüküyor. Ancak, bilimsel

[125] Burada örnek olarak Neurath'ın *Ballungen* hakkındaki görüşü düşünülebilir. (Burada kastedilen, bilim adamlarının araştırma süresince kullandıkları kesin olmayan (imprecise) terimlerdir. Örneğin; gündelik dil içerisinde kullandığımız terimler.) Benzeri bir düşüncenin sonucu olarak Neurath, bilimsel dili evrensel "argo" olarak tanımlamıştır.

bilginin belirli bir ölçüde dış dünyaya bağlılığını doğru kabul edersek, bu tarz bir bilginin deneyci bir çerçevede açıklanması ya da en azından böylesi bir çerçeveye açıklama içerisinde yer verilmesi bir zorunluluk haline geliyor. Üzerinde herhangi bir düzenleme yapılmadan Neurath'ın pozisyonu uygulanmaya kalkışılırsa, bilimsel aktiviteyi değerlendirmeye çalışan her kimse şu sonuçla karşılaşacaktır: Bilim insanlarının dış dünyaya dair geliştirdikleri teorilere güvenmek zorundayız çünkü onların çabaladıkları şey daha keskin, daha kapsamlı ve daha zengin bir dünya yorumuna varmaktır. Burada anlatılmaya çalışılanı Neurath'ın gemi metaforu ile daha açık bir şekilde ifade edebiliriz. Bilimi seyahat halindeki bir gemi olarak düşünelim. Eğer bu gemi herhangi bir limana uğramadan çeşitli teorik güzergâhların arasında su üstünde kalmayı başarabiliyorsa, geminin seyrini değerlendirmeye çalışan bir kimse şunu *hiçbir tereddütte düşmeden* rahatlıkla söyleyebilir: geminin o anda izlediği güzergâh güvenilir olandır. Başka bir deyişle, o güzergâh rasyonel olandır. Ancak, bu değerlendirmeyi yapan kimse *hiçbir zaman* o anda izlenen güzergâhın en mutlak veya en tutarlı, ya da 'hakiki' yol olduğunu bilemez çünkü ispat edemez. Bu noktada, değerlendirmeyi yapmaya çalışan kimse haklı olarak şunu sorabilir: Neurath'ın yaklaşımını sorgulamadan kabul edersek, bilimsel bilgiyi bizlerle tanıştıran bilim insanlarının yalnızca deneyimi takip ederek dünya tasvirleri arasında gerçekten de en verimlisine ve en işlevseline ulaştığına nasıl emin olabiliriz? Diğer bir ifadeyle, tüm temellerden ve dayanak noktalarından vazgeçildiği takdirde, bilim insanlarının tutarlı bir 'bilimi' inşa ettiğine nasıl güvenebiliriz? Belki de tamamıyla konvansiyonel temellere uygun olarak sözde-güvenilir bir masallar bütününü savunuyorlardır.[126] Benzer bir şüpheyle Elie Zahar (2007), yapısal realizmi savunduğu *Bilim Metafiziğe Neden İhtiyaç Duyar* (*Why Science Needs Metaphysics*) kitabında Neurath'ın görüşünü son derece göreceli (rölativist), dolayısıyla geçersiz bir pozisyon olarak niteler. Zahar'ın düşüncesine göre Neurath'ın yaklaşımındaki tutarsızlık yalnızca temelde olanı (deneysel raporların bulunduğu seviyeyi) etkilememekte, aksine matematiği de dâhil edecek biçimde tüm teorik bilimleri kapsamaktadır [Zahar, 2007: 34].

[126] Karl Popper (2002), Neurath'ın yaklaşımındaki bu soruna işaret etmiştir.

Bu noktada önemli bir konuya dikkat çekmek istiyorum. Neurath'ın yaklaşımındaki sorunlu kısımlara dair yapılan tespitler bizleri başka bir görüş aramaya itecek kadar caydırıcı olmamalıdır. Neurath'ın felsefesindeki verimliliği yeniden keşfetmek üzere başlatılan bu analizin bir hayal kırıklığı ile sonlanıp bilimsel aktiviteyi değerlendirebilecek başka bir bilimsel realist (veya realizm karşıtı) görüşe yönelmesi varılan bu noktada söz konusu değildir. Bu tezin amacını tekrar ifade etmek gerekirse, buradaki analizin ana hedefi, verimli ve hassas bir biçimde bilimsel yöntembilimsel pratiğe uygulayabilecek bir alet çantasının olasılığını araştırmaktır. Eğer böylesi bir alet çantası normatif bir kısıtlamaya tabi olmayan bir içerikle tanıtılabilirse bu aletlerle yapılacak bilimsel değerlendirmeler teori değişim sürecini de açıklayabilen bir verimlilikle gerçekleştirilebilir. Bu öncülleri hakkıyla karşılayabilmek için Neurath'ın yaklaşımının hala uygun bir aday olduğu söylenebilir. Bir önceki paragrafta kimi olumsuzluklara dikkat çekilerek belirtilen mesele daha çok şu çıkarıma işaret etmektedir: Neurath'ın yaklaşımına dair yapılan kimi yakıştırmaları (göreceli, sübjektif ve dolayısıyla geçersiz) defetmek için kimi düzenlemelerle bazı ayrıntılar eklemek gerekiyor. Peki, bu yeni ayarlamalar hangi yönde ve ne şekilde yapılmalıdır?

Neurath'ın görüşünü iyileştirmeye girişmeden önce, bilim insanları tarafından kullanılan kimi varsayımların ve prensiplerin 'metafiziksel' niteliğe sahip oldukları kabul edilmelidir[127]. Başka bir ifadeyle, bilimsel araştırmalar içerisinde höristik ilkeler şeklinde kullanılan ve bir teorinin tahmin etme ve açıklayıcı olma başarısını yükseltmeye yardımcı olan bazı test edilemeyen varsayımlar bulunmaktadır. James Ladyman, *Bilim, Metafizik ve Yöntem* (*Science, Metaphysics and Method*) (2012) makalesinde bilimsel pratikteki metafiziğin höristik değerini göstermek amacıyla

[127] Burada geçen 'metafiziksel' terimi, 'deneyim yoluyla doğrudan doğrulanamayan' anlamını taşımaktadır. Metin içerisinde birden fazla kez geçen bu terim her defasında bu anlamına referansla kullanılmaktadır.

fizik tarihinden birkaç örnek sunmaktadır. Ladyman, en popüler örneklerden biri olan atomculuğun tarihçesini şu şekilde tanımlıyor:

> *Atomculuk* – maddenin küçücük parçacıklardan oluştuğunu iddia eden düşüncedir. Atomculuğun iddiasına göre, bu parçacıkların dinamik ve yapısal niteliklerinin renkler ve dokular gibi gündelik nesnelerin özelliklerini oluşturabilme olanağına sahip olabileceği, ilk başlarda herhangi bir gözlem sonucuna dayanmadan tamamen metafiziksel bir varsayım olarak ortaya çıkmıştı. Bu spekülatif varsayım, kimyasal atomlara, gazların kinetik teorisine ve sonunda atom altı dünyaya kadar geliştirildi [Ladyman, 2012: 47, çeviri tez yazarına ait].

Ladyman'in makalesinde açıklanan örneklere ilave olarak, metafiziksel varsayımların bilim pratiği içerisindeki varlığına işaret etmek için ışık bilimi[128] tarihinden başka bir örnek verilebilir. On dokuzuncu yüzyılda rakibini (parçacık teorisini) yenilgiye uğratan dalga ışık teorisi, Thomas Young (1773-1829), Augustine Fresnel (1788-1827), François Arago (1786-1853), James Clerk Maxwell (1831-1879) ve diğer bilim insanlarının katkılarıyla geliştirilmiştir. Ancak, dalga ışık teorisinin inşasına dair çalışmalar bu bilim insanların başarılarından çok daha uzun zaman öncesine dayanmaktadır. Christiaan Huygens (1629-1695), ses ve ışık arasında bir *analoji* kurarak ışığın tıpkı ses dalgaları gibi dalga şeklinde yayıldığı varsayımında bulunmuş ve bu varsayımı Huygens prensibi adıyla çalışmalarında açıklamıştı. Bu prensip daha sonra Fresnel'in kırılma ('diffraction') konusundaki araştırmasının kazandığı başarıda da kritik noktayı oluşturmaktadır. Ses ve ışık gibi deneyim yoluyla test edilemeyen iki olgu arasında kurulan bir analojinin nasıl bir keşif aracına dönüştüğünü ve bunun başarılı bir teorinin gelişimine nasıl yol açtığını gözlemlemek dikkat çekicidir. Sonuç olarak iki ayrı fenomen arasında analoji kurma işleminin bilim insanları tarafından yeni tahminlerde bulunabilecek ve açıklamalar getirebilecek teorilerin inşası için

[128] Dalga ışık teorisinin on dokuzuncu yüzyılın başındaki gelişimi, tez yazarının Yüksek Lisans (Master of Arts) tezinde (2013) incelenmiştir. Bu paragrafta sözü geçen ışık bilimi tarihindeki detaylar için, Whittaker, E.T. (1951), *A History of the Theories of Aether and Electricity. The Classical Theories*, London: Thomas Nelson kitabına bakılabilir. Huygens, Young ve Fresnel'in orijinal çalışmaları için, Crew, H. (1900), *The Wave Theory of Light: Memoirs of Huygens, Young, and Fresnel*, New York: American Book Company kitabına bakınız.

kullanılması, metafiziksel varsayımların höristik değerine dair birer delil niteliğindedir.

Neurath'ın bilimsel pratik içerisinde metafiziğe biçtiği yarar yalnızca höristik açıdan değil, aynı zamanda felsefesinde önemli bir yer tutan konvansiyonlar özelinde de incelenmelidir. Deneysel verimliliği maksimize etmek amacıyla teorik bir terime belirli bir anlamın yüklenmesi ile sonuçlanan karar süreçleri kolay kolay deneyim yoluyla test edilemez. Örneğin; fizikçiler 'ışık' terimine 'elektro-manyetik dalga', 'foton akışı' veya 'dalga-parçacık ikiliği gösteren bir olgu' şeklindeki anlamları konvansiyonel olarak yüklemektedir. Yalınlık, bütünlük ve verimlilik gibi kimi yüksek derece uzlaşımlar bilim insanlarının söylemindeki anlam birlikteliğinin kaynağıdır. Bilimsel pratik içerisinde bu tarz uzlaşımların sahiplenilmesi elbette ki bu doğrultuda geliştirilen bir teorinin tahminde bulunma gücünü yükseltmektedir, fakat bu teorik içeriklerin hiçbiri deneyime dayanmamaktadır. Sonuç olarak, bilimsel ifadeler bütününün efektif olarak sistemleştirilmesine ve işlenmesine yardımcı olan teorik terimler ve hipotezler, konvansiyonel kararlar ile tutarlı ise kabul görür ve bu kabulün kendisi metafiziksel bileşenler içermektedir. Yine de şu söylenmelidir ki metafiziksel niteliğe sahip bileşenlerin bilimsel pratikte kullanılması bilimsel bilginin güvenilir bir biçimde kurulmasına müdahale etmemektedir.

Eğer bilimsel aktivite içerisinde bazı metafiziksel varsayımların sorun yaratmadan kullanılması kabul görürse, sürecin bu özelliği Neurath'ın yaklaşımına ne şekilde uygulanabilir? Tezin inceleme hususlarına uygun olarak bu özellikler, Neurath'ın bilim anlayışındaki temelcilik karşıtı tutumunu bozmadan ve aynı zamanda (genel) bir deneyci pozisyonunu koruyarak uygulanmalıdır. Bu görevi layıkıyla yerine getirebilecek bir yol, Viyana Çevresi'nin doğrulanabilirlik prensibinin Neurath'ın protokol cümleleri ile yeniden tanımlanıp birleştirilmesiyle mümkün hale geliyor. Bu alternatifi detaylı olarak tarif etmeden önce doğrulanabilirliğin ve Neurath'ın protokol cümlelerinin orijinal tanımlarını vermek gerekiyor:

(1) Doğrulanabilirlik prensibi (Schlick, Waismann): Bir ifadenin anlamı bu ifadenin doğrulanabilirlik yöntemidir.

(2) Protokol cümlesi (Neurath): Yevgeniya'nın saat 16:03'te olan protokolü: [Yevgeniya'nın saat 16:02'de olan beyan düşüncesi şöyleydi: (Saat 16:01'de, yolun karşı kenarında Yevgeniya tarafından yeşil bir araba gözlemlenmişti)].

Bazı doğrulanamaz metafiziksel varsayımların bilim adamları tarafından fiilen kullanıldıklarını önceki paragraflarda açıklamıştım. Dolayısıyla Schlick ve Waisman'nın tanımıyla Viyana Çevresi'nin geri kalan üyelerinin aklındaki doğrulanabilirlik prensibi arasında yüzde yüz bir uyuşma olmadığı kabul edilmelidir. Bununla bağlantılı olarak, orijinal tanımın iddia ettiği tüm ifadeleri anlamlı (bilimsel) ve anlamsız (metafiziksel) olarak katı bir şekilde ayırma prosedürünün de maalesef çalışmadığı belirtilmelidir. Sonuç olarak, Viyana Çevresi'ndeki bazı üyelerin doğrulanabilirlik ve anlam arasında kurdukları zorunlu ilişki kırılmalıdır. Eğer bilim insanlarının ana amacı, tahmin etme gücü ve deneysel başarısına bakarak belirli olgular hakkında olabildiğince kapsamlı bir teorik anlayışı inşa etmekse bunun doğrulanabilirlik derecesinin yüksek olması tabii ki önemlidir. Ancak, eğer bu amacın gerçekleştirilmesi için aynı zamanda bazı metafiziksel bileşenlerin kullanılması gerekiyorsa, tüm metafiziksel ifadelerin 'anlamsız' olduğu iddiası bizi tutarsızlığa sürükleyecektir.

Eğer hal böyleyse doğrulanabilirliğe dair tutarlı bir anlayış nasıl oluşturulabilir? Benim fikrimce alternatif bir anlayış mümkün. Doğrulanabilirlik prensibini anlam kavramının üzerine inşa etmek yerine, bir teorinin tahmin etme içeriğini yükseltmek için somut sorulan yönelten bir araç olarak tanımlayabiliriz. Eğer bu modifiye edilmiş doğrulanabilirlik kuramı bir biliminsanına *x'i* 'x+y=6' yerine 'x+2=6' zemininde sorgulatmaya izin verecekse, bu biliminsanının çabalarının daha efektif ve verimli bir hal aldığını söyleyebiliriz. Tam bu noktada, Neurath'ın protokol cümleler hakkındaki görüşü, doğrulanabilirliğin yeniden kavramsallaştırılması için kritik bir katkı sağlayabilir. Eğer Neurath'ın protokol cümleleri tekil ifadeler (singular propositions) veya "belirli bir birey hakkında olan ve bu bireyi doğrudan ifadenin kurucusu olarak dâhil eden ifadeler" (Fitch and Nelson, 2018) olarak

tanımlanırsa, bu protokoller sorunsuz bir biçimde öznelerarası testin[129] uygulanması ile doğrulanabilir. Bu süreç, bilimsel araştırmanın teorik bileşenleri adına deneyci çerçevede güvenilir bir zeminin[130] oluşumu için temeli oluşturacaktır. Sonuç olarak, böylesi bir araştırmayı sürdüren bir biliminsanı, protokol seviyesindeki ifadeleri doğrulanabilirlik prensibi tarafından 'sabitlendiği' için daha somut sorular sorabilecek ve dolayısıyla üzerinde çalıştığı hipoteze daha çok güvenebilecektir. Bütün bu süreci yorumlamaya çabalayan bir bilim felsefecisi ise, bilim aktivitenin rasyonel olduğunu ancak bu rasyonelliğin temelcilik karşıtı bir yaklaşım çerçevesinde ayarlanabilir olduğunu savunabilecektir. Bu felsefi yoruma test edilemez (metafiziksel) içeriklere izin verebilecek ve aynı zamanda (esaslı) deneyci kapsamın içinde kalacaktır[131]. Tüm bunlara ek olarak, protokol ifadelerin tekil olarak tanımlanması, tümevarım[132] problemine yol açmadığı için yeniden kavramsallaştırılmış olan doğrulanabilirlik kavramının işlevsellik değerini yükseltecek ve dolayısıyla tekil protokoller vasıtasıyla inşa edilen bu teori, 'deneysel verilere göre eksik belirlenim' (underdetermination) probleminin çıkma ihtimalini en aza indirebilecektir.

Yukarıda açıklandığı üzere doğrulanabilirlik kavramının Neurath'ın tekil protokol ifadeleri vasıtasıyla yeniden kavramsallaştırılması ve bunun daha somut sorular

---

[129] Tezin üçüncü ve dördüncü kısımlarında anlatıldığı gibi, Neurath öznelerarası testi sorunsuz bir şekilde gerçekleştirmek için protokol cümlelerin tanımını belirli bir formatta sunmuştu. Bu format (bir önceki sayfanın ikinci paragrafında belirtildiği gibi), Neurath'a göre bir protokol ifadelerin güvenilirliğini artıracaktı.

[130] Buradaki 'zemin' kelimesi, protokol ifadelerin bilimsel bilginin değişmez temelini oluşturabilme olanağına işaret etmek için kullanılmamıştır. Daha ziyade burada protokol ifadelerin kavrama sürecini daraltarak odaklamaya yönelik elverişli araçlar geleceği varsayılmaktadır.

[131] Bu şekilde, deneyciliğin 'bütün bilgiler deneyimden gelir' iddiası, Neurath'ın savunduğu yaklaşım tarafından kapsanmaktadır ve onun yaklaşıma karşı yöneltilen görelilik ve öznelcilik iddialarına yanıt olarak kullanılabilir.

[132] Tümevarım sorunu kabaca şöyle tanımlanabilir: Bir genellemeyi oluşturmak için gözlemlenen benzer niteliklerin sayısı ne kadar çok olursa olsun oluşturulan bu genelleme tek bir karşı gözlem sonucunda çürütüleceği için hiçbir zaman tam olarak güvenilir sayılmayacaktır. Örneğin; 'Tüm kuğular beyazdır' ifadesi, tek bir siyah kuğu gözlemlendiği anda yanlışlanır. Tekil ifadeler, genel örnekleme (universal instantiation) prosedürüne uygun olmadıkları için tümevarım probleminin kapsamına girmezler.

sorma konusunda sağladığı yarar bilim tarihinden bir örnek üzerinden gösterilebilir. Işık bilim tarihi örneği üzerinden devam edelim. On yedinci yüzyılın ışık biliminde, Isaac Newton tarafından geliştiren parçacık teorisinin ışığın doğasına dair kapsamlı ve tutarlı bir açıklama sunduğu kabul edilmişti. Temel olarak bu teori, ışığı ışık kaynağından yayılan küçücük parçacıklar akışı olarak tanımlıyordu. Işık bilimciler, bu temel varsayımı kullanarak farklı ortamlardaki yansıma ve kırılma gibi değişik optik olguları açıklayabiliyorlardı. Ancak, ışığın kırılma özelliği (diğer ifadeyle ışığın küçük bir aralıktan geçtiğinde gözlemleme ekranında bıraktığı karanlık ve aydınlanlık şeritler olgusu) Francesco Grimaldi (1618-1663) tarafından keşfedildikten sonra, parçacık teorisi bir sorunla karşılaşmıştı. Parçacık teorisinin temel varsayımına göre, kaynaktan yayılan parçacıkların gözlemleme ekranının ortasını en parlak nokta haline getirecek ve ekran üzerinde herhangi bir şerit oluşturmayacaktı. Genç Fransız bilim adamı Augustine Fresnel, önceki sayfalarda açıklandığı üzere ses ve ışık arasında kurduğu analoji ile desteğini açıkladığı dalga ışık teorisi üzerinde çalışmalarına devam ediyordu. Yine aynı teoriden ilham alarak kırılma olgusuna dair muhtemel bir açıklama üzerinde çalışmaktaydı. Tezin amacına uygun bir biçimde, Fresnel'in elindeki deneysel verinin tekil protokol ifade şeklinde yazıldığı farz edilirse, şu şekilde bir cümle ortaya çıkacaktır:

> (2') Fresnel'in saat 13:03'te olan protokolü: [Fresnel'in saat 13:02'deki beyan düşüncesi şöyleydi: (saat 13:01'de, merkezde küçük aralığı olan ışığı geçirmez nesnenin *m* santimetre uzaklığında bir ışık kaynağı yerleştirilmiş ve ışık bu küçük aralıktan geçtiği sırada, gözlemleme ekranında *n* sayıda karanlık ve aydınlanmış şeritler Fresnel tarafından gözlemlenmiştir)].

Yukarıdakine benzer şekilde açıkça doğrulanabilir bir ifadeden yola çıkan Fresnel, parçacık teorisine alternatif bir bilimsel açıklamanın kırılma olgusu aracılığıyla sunulabileceğine inanmaktaydı ve çalışmalarını bu doğrultuda sürdürdü. Bu açıklamanın başarılı olabilmesi için aranan alternatifin başlangıçtaki protokol ifadeyle uyumlu olması gerekiyordu. Çalışmalar ilerledikçe Fresnel ilk teorik hipotezini oluşturmuştu, fakat bu denemesi deneysel ve teorik hesaplamalar arasındaki uyuşmazlığın büyük olmasından ötürü başarısızlıkla sonuçlanmıştı. İkinci denemesinde Fresnel, daha önce Huygens tarafından tanımlanan ve onun

adını taşıyan prensibi uygulamaya karar verdi. Bu prensibi kuramsal olarak teorisinin kapsamına dâhil edebilmek amacıyla Fresnel, entegral sistemi oluşturdu. Bu sistem vasıtasıyla son derece hassas hesaplamalar gerçekleştirdi ve kimi teorik sonuçlar elde etti. Bu hesaplama sonuçlarını sadece daha önce gözlemlenmiş deney verileriyle test etmiyordu. Aynı zamanda herhangi bir '*m*' ve '*n*' değerindeki şerit düzenini yüksek doğruluk derecesiyle tahmin etmek için de bu hesaplamaları kullanabiliyordu. Bu şekilde Fresnel, dalga ışık teorisi kapsamında kırılma olgusunun başarılı bir açıklamasını oluşturdu. Bu açıklamanın başarısı olarak Fresnel'in geliştirdiği hipotezin şu özellikleri gösterilebilir: tahmin etme ve açıklayıcılık gücü[133]. Bu örneğin bize gösterdiği ise tekil ve açıkça doğrulanabilir gözlem ifadelerine referans veren bir biliminsanının sürdürdüğü araştırmayı daha da geliştirmek adına daha belirgin sorular sormaya ve daha özelleştirilmiş bir inceleme yürütmeye teşvik edebilir olduğudur. Bu tespit de tekil protokol ifadeler aracılığıyla yeniden kavramsallaştırılan doğrulanabilirlik anlayışının bir biliminsanını daha verimli bir araştırmaya teşvik etmek için elverişli bir araç haline gelebileceğini işaret ediyor.

Yine dikkat edilmesi gereken bir nokta, doğrulanabilirlik prensibinin yukarıda açıklandığı üzere yeniden düzenlenmesi, bu anlayışın genel olarak tüm bilimsel faaliyetlerin tek ve değişmezi olacağı anlamına gelmemelidir. Yukarıda belirtildiği gibi, metafiziksel varsayımların ve prensiplerin bilimsel aktivitedeki höristik rolü inkâr edilemez. Yine de bu kabul, metafiziksel araçların bilimsel anlayışın değişmez ve tartışılmaz temelini oluşturacağı anlamına gelmemektedir. Daha da ilerletilecek olursa, Neurath'ın felsefi tutumunun sadece ve sadece doğrulanabilirliğin bu şekilde yeniden tanımı aracılığıyla düzeltilebilir olduğu iddiası da bu incelemenin amaçları arasında değildir. Bu tezin dikkat edilmesi gereken en önemli tarafı, Neurath'ın temelciliğe karşı olan tutumunun desteklenmesidir. Dolayısıyla bir varsayımın otoriter ve sorgulanamaz olarak kabul

[133] Fresnel'in kırılma olgusu üzerine yazdığı orijinal inceleme raporu için Crew, H. (1900), *The Wave Theory of Light: Memoirs of Huygens, Young, and Fresnel*. New York: American Book Company kitabına bakılabilir.

edilmesi bu tezin inceleme çerçevesine uygun değildir. Yine de Neurath'ın yaklaşımındaki temelcilik karşıtı tutum ile güvenilebilir bilginin tek kaynağı olarak bilimin gösterildiği deneyci tez arasında kurulan hassas dengenin korunması da oldukça önemlidir. Bu bağlamda, metafiziksel varsayımların kullanımı dikkatli bir şekilde gerçekleştirilmelidir. Diğer bir ifadeyle, bilimsel faaliyetlerin değerlendirilmesinde metafizik, höristik bir güç olarak ancak şu şekilde yardımcı olabilir:

> …metafiziksel fikirler bilim için sadece anlamlı değil, bilim için gerekli fikirlerdir. Bu fikirler, kimi bilimsel teorilerin inşasında ve deneyimle karşılaştırılması hususunda vazgeçilmez çerçeveler sunmaktadır. Metafizik, bilim için rehberlik yapıyor, bir höristik rol oynuyor. Fakat metafiziksel rehberliğin bir yönde ilerlemesi gerektiği için, bu rehber kolaylıkla hem yanlış hem de doğru yöne yönlendirebilir. Bu unsur, bilimde başarılı olmanın sihirli bir formülünün olmadığını göstermektedir. Çoğu zaman, bilimsel araştırmanın doğru çıkışları bulabilmesi için yanlış yolları da keşfetmesi gerekir [Gillies, 1993: 201, çeviri tez yazarına ait].

Son olarak, bu özetin önceki sayfalarında bahsedilen Neurath'ın sosyal, ekonomik ve politik faktörlerin bilimsel aktivitede mühim bir rol oynadıklarına dair vurgusu, onun bilimsel araştırmasını yorumlarken hiçbir zaman unutulmamalıdır. Bilimsel aktiviteyi değerlendirirken Neurath'ın mirasını takip etmeli ve aktivitenin sadece iç faktörlerini değil, biliminsanının araştırmasını etkileyebilecek dış faktörleri de hesaba katmalıyız. Bir ülkenin genel sosyo-politik durumu, maddi kaynaklara ve deneyim araçlarına erişebilirlik, biliminsanına özgü hevesler ve ilham aldıkları kişi ve olaylar gibi dış faktörler ilk bakışta önemsiz gözükebilir. Ancak tez boyunca inşa edilmeye çalışılan değerlendirme biçiminin ana özelliklerinden biri hassasiyet ise, bu dış etkenler de yapılan yorumun içine katılmalıdır. Ancak bu şekilde 'bilim' adındaki geminin hangi yöne doğru ilerlediğini yaklaşık bir tahminle olsa dahi anlayabiliriz. Yine de her şeye rağmen, bu gemideki denizcilerin nihai hedefinin gemiyi sonsuz keşifler denizinde su üstünde tutmak olduğu hiçbir zaman unutulmamalıdır.

C. TEZ İZİN FORMU / THESIS PERMISSION FORM

ENSTİTÜ / INSTITUTE

Fen Bilimleri Enstitüsü / Graduate School of Natural and Applied Sciences ☐

Sosyal Bilimler Enstitüsü / Graduate School of Social Sciences ☐

Uygulamalı Matematik Enstitüsü / Graduate School of Applied Mathematics ☐

Enformatik Enstitüsü / Graduate School of Informatics ☐

Deniz Bilimleri Enstitüsü / Graduate School of Marine Sciences ☐

YAZARIN / AUTHOR

Soyadı / Surname : Kulandina
Adı / Name : Yevgeniya
Bölümü / Department : Philosophy

TEZİN ADI / TITLE OF THE THESIS (**İngilizce** / English) : THE HERITAGE OF THE VIENNA CIRCLE: THE REVIVAL OF EMPIRICISM THROUGH THE ASSIMILATION OF METAPHYSICS

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans** / Master ☐ **Doktora** / PhD ☐

1. **Tezin tamamı dünya çapında erişime açılacaktır. /** Release the entire work immediately for access worldwide. ☐
2. **Tez iki yıl süreyle erişime kapalı olacaktır.** / Secure the entire work for patent and/or proprietary purposes for a period of **two years. *** ☐
3. **Tez altı ay süreyle erişime kapalı olacaktır.** / Secure the entire work for period of **six months**.***** ☐

** Enstitü Yönetim Kurulu kararının basılı kopyası tezle birlikte kütüphaneye teslim edilecektir. A copy of the decision of the Institute Administrative Committee will be delivered to the library together with the printed thesis.*

Yazarın imzası / Signature ..... **Tarih** / Date : 06.08.2019