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Logical Positivism

(Also known as logical empiricism, logical neopositivism, neopositivism). School of philosophy risen in Austria and Germany during 1920s, primarily concerned with the logical analysis of scientific knowledge. Among its members were Moritz Schlick, founder of the Vienna Circle, Rudolf Carnap, the leading figure of logical positivism, Hans Reichenbach, founder of the Berlin Circle, Herbert Feigl, Philipp Frank, Kurt Grelling, Hans Hahn, Carl Gustav Hempel, Victor Kraft, Otto Neurath, Friedrich Waismann.

Logical positivists denied the soundness of metaphysics and traditional philosophy; they asserted that many philosophical problems are indeed meaningless. During 1930s the most important representatives of logical positivism emigrated to USA, where they influenced American philosophy. Until 1950s logical positivism was the leading philosophy of science; today its influence persists especially in the way of doing philosophy, in the great attention given to the analysis of scientific thought and in the definitely acquired results of the technical researches on formal logic and the theory of probability.

The following paragraph (*The main philosophical tenets of logical positivism*) explains the fundamental principles of logical positivism, namely the verifiability principle and its consequence, the logical structure of scientific theories and the meaning of probability. The paragraph *Biographical notes* gives essential information about the life of Feigl, Frank, Grelling, Hahn, Neurath, Schlick and Waismann, with some neopositivist's philosophical ideas that, for sake of exposition, did not find room in the principal text. There are three separate articles about Carnap, Hempel and Reichenbach. The historical development of logical positivism is outlined in three paragraphs: *Before the logical positivism*, which deals with the main influences that were exerted on the rising logical positivism; *Early researches in Europe* and *The American period*, whose titles are self-explanatory. Finally, the influences exerted by logical positivism on English, French, Italian, Polish and Scandinavian philosophy are sketched out in the paragraph *Influences on European philosophy*.

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The Main Philosophical Tenets of Logical Positivism

According to logical positivism, there are only two sources of knowledge: logical reasoning and empirical experience. The former is analytic a priori, while the latter is synthetic a posteriori; hence synthetic a priori does not exist.

> The fundamental thesis of modern empiricism consists in denying the possibility of synthetic a priori knowledge.
> (H. Hahn, O. Neurath, R. Carnap, *Wissenschaftliche Weltauffassung. Der Wiener Kreis*, 1929).

Logical knowledge includes mathematics, which is reducible to formal logic. Empirical knowledge includes physics, biology, psychology, etc. Experience is the only judge of scientific theories; however, logical positivists were aware that scientific knowledge does not exclusively rise from the experience: scientific theories are genuine hypotheses that go beyond the experience.

> It is not possible to establish a logically durable building on verifications [a verification is an observational statement about immediate perception], for they are already vanished when the building begins. If they were, with respect to time, at the beginning of the knowledge, then they would be logically useless. On the contrary, there is a great difference when they are at the end of the process: with their help the test is performed... From a logical point of view, nothing depends on them: they are not premises but a firm end point.
> (M. Schlick, 'Über das Fundament der Erkenntnis', in *Erkenntnis*, 4, 1934).

A statement is meaningful if and only if it can be proved true or false, at least in principle, by means of the experience -- this assertion is called the verifiability principle. The meaning of a statement is its method of verification; that is we know the meaning of a statement if we know the conditions under which the statement is true or false.

> When are we sure that the meaning of a question is clear? Obviously if and only if we are able to exactly describe the conditions in which it is possible to answer yes, or, respectively, the conditions in which it is necessary to answer with a no. The meaning of a question is thus defined only through the specification of those conditions...
> The definition of the circumstances under which a statement is true is perfectly *equivalent*

> to the definition of its meaning.
> ... a statement has a meaning if and only if the fact that it is true makes a verifiable difference.
> (M. Schlick, 'Positivismus und Realismus' in *Erkenntnis*, 3, 1932).

Metaphysical statements are thus forbidden: they are meaningless. Also the traditional philosophy is indeed meaningless, and the only role of philosophy is the clarification of the meaning of statements.

> Philosophy is the activity by means of which the meaning of statements is clarified and defined.
> (M. Schlick, 'Die Wende der Philosophie' in *Erkenntnis*, 1, 1930).

A scientific theory is an axiomatic system that obtains an empirical interpretation through appropriate statements called rules of correspondence, which establish a correlation between real objects (or real processes) and the abstract concepts of the theory. The language of a theory includes two kinds of terms: observational and theoretical. The statements of a theory are divided in two groups: analytic and synthetic. Observational terms denote objects or properties that can be directly observed or measured, while theoretical terms denote objects or properties we cannot observe or measure but we can only infer from direct observations. Analytic statements are a priori and their truth is based on the rules of the language; on the contrary, synthetic statements depend on experience, and their truth can be acknowledged only by means of the experience. This conception about the structure of scientific theories is perhaps the most durable philosophical principle of the logical positivism. It was proposed by H. Reichenbach and R. Carnap -- see H. Reichenbach, *Philosophie der Raum-Zeit Lehre*, 1928 (English translation: *The philosophy of space and time*, 1958) and R. Carnap, 'Testability and meaning' in *Philosophy of science*, 3, 1936 and 4, 1937 -- and was supported by C. G. Hempel, *Fundamentals of concept formation in empirical science*, 1952; R. B. Braithwaite, *Scientific explanation*, 1953; E. Nagel, *The structure of science*, 1961; R. Carnap, *Philosophical foundations of physics*, 1966; M. Ruse, *Philosophy of biology*, 1971.
Its main points are:

- the distinction between observational and theoretical terms
- the distinction between synthetic and analytic statements
- the distinction between theoretical axioms and rules of correspondence
- the deductive nature of scientific theories

These four points are linked together. Rules of correspondence give an empirical meaning to theoretical terms and are analytic, while theoretical axioms express the observational portion of the theory and are synthetic. A theory must be a deductive systems; otherwise, a formal distinction between the various kinds of sentences and terms is impossible.

The distinction between observational and theoretical terms depends on the verifiability principle. A statement is meaningful only if it is verifiable; but, in scientific theories, there are many statements

which are not verifiable -- for example, assertions dealing with quantum particles or relativistic gravitational fields. These statements are too abstract for a direct test; strictly speaking, they are meaningless. To avoid such a consequence, two different approaches were proposed. According to Schlick, the principles of a scientific theory are not statements, but rules of inference; hence the problem of their meaning does not arise ('Die Kausalität in der gegenwärtigen Physik' in *Die Naturwissenschaften*, 19, 1931). The other solution was proposed by Neurath: the terms which belong to the abstract language of a scientific theory are explicitly definable in a restricted language whose terms describe directly observable objects ('Physikalismus' in *Scientia*, 50, 1931). So a distinction between observational and theoretical terms arose. But soon Carnap realized that theoretical terms are not definable by observational ones. In a first time, he proposed a partial reducibility of theoretical to observational terms ('Testability and meaning', in *Philosophy of science*, 3, 1936 and 4, 1937). Later, it was supposed that all theoretical terms were removable from a scientific theory. This hypothesis was supported by two outcomes of formal logic: Craig theorem and Ramsey statement.

Craig theorem is an unquestionable result of formal logic. Let A and B be two set of statements, so that B is a logical consequence of A. Craig proved that (i) there is a set C of statements whose terms are common to A and B, (ii) C is a logical consequence of A and (iii) B is a logical consequence of C. Therefore, if A is the set of axioms of a scientific theory and B is the set of observational statements implied by A, then there is a set C, whose terms are common to A and B and thus they are the observational terms which occur in the axioms, so that C entails B and is a consequence of A. According to Craig theorem, it is possible to translate a scientific theory in a purely observational language without any loss of deductive power.

Ramsey sentence, named after English philosopher Frank Plumpton Ramsey (1903-1930), was used by Carnap for dividing the axioms of a theory in two sets, say A and R, so that R contains only observational terms and expresses the empirical portion of the theory, while A is analytic and defines the meaning of theoretical terms (see Carnap for a full explanation).

Given a theory T, it is thus possible to build a theory T* without theoretical terms so that T and T* are equivalent with respect to observational statements, that is every observational statement O is a logical consequence of T if and only if is a logical consequence of T*.

While the analysis of relationships between the two kinds of terms began the object of many logical and philosophical studies, the distinction itself was criticized. According to Popper all scientific concepts are theoretical, for every assertion not only entails hypotheses but also is hypothetical, that is not sure and always falsifiable. Quine ('Two dogmas of empiricism' in *The Philosophical Review*, 60, 1951) criticized both observational-theoretical and analytic-synthetic distinction. Hempel ('The theoretician's dilemma' in *Minnesota studies in the philosophy of science*, II, 1958) noted that the theory T* without theoretical terms, in spite of the equivalence (with respect to the observational language) to the original theory T, is not useful as T. In fact, from an inductive point of view, T and T* are very different. Usually the original theory T suggests certain relations between its concepts, while in T* these concepts are forbidden. The discovery of laws is almost impossible in T*, while it is a natural consequence in T.

Moreover, while the number of the axioms of T usually is finite, Craig theorem does not assure us of the existence of a theory T* with a finite number of axioms. So T* is almost useless. Theoretical terms are thus necessary in science.

Hempel's work 'The meaning of theoretical terms' in *Logic, methodology and philosophy of science IV*, 1973, includes a new criticism of the observational-theoretical distinction. The two main points of Hempel's analysis are:

- Observational terms do not exist. It is only possible a distinction between terms used in a given theory and new terms employed for the first time in a new scientific theory. For example, Bohr's atomic theory includes terms like quantum numbers, quantum jump, steady state, and explains spectra described with the help of wavelength. Now wavelength is an 'old term' while quantum number is a 'new term'. Thus the abstract concepts of atomic theory are linked with other abstract (but already given) concepts.
- The meaning of theoretical terms is not defined by analytic statements which are true by convention. In fact, every statement is subject to empirical tests. In a scientific theory there is no room for 'true by convention'.

In *Philosophical foundations of physics*, 1966, Carnap proposed a slightly different approach to observational-theoretical distinction. Now the starting-point is the difference between empirical and theoretical laws. It is possible to directly confirm (or disprove) an empirical law, while a theoretical law can be tested only through the empirical laws that are among its consequences. Moreover, an empirical law explains facts while a theoretical law explains empirical laws. Thus there are three levels:

1. Empirical facts.
2. Simple generalizations we can directly test: empirical laws. They explain facts and are employed to forecast facts.
3. General principles we can use to explain empirical laws: theoretical laws.

Empirical laws include observational terms, while theoretical terms occur in theoretical laws.

The distinction between analytic and synthetic statements is another consequence of the verifiability principle and it is linked with the observational-theoretical as well as axioms-rules of correspondence distinction. According to the verifiability principle, an alleged synthetic a priori statement does not have a meaning; thus there are only two kinds of assertions: synthetic a posteriori and analytic a priori. First of all, what is the role of analytic sentences in a scientific theory? Only two possibilities are allowed: an analytic statement is a logical-mathematical theorem (thus it has no empirical significance) or it is a convention that defines the meaning of theoretical terms. Really, the solution to the problem about the meaning of theoretical terms that Carnap proposed ('Beobacthungssprache und theoretische Sprache' in *Dialectica*, 12, 1958; English translation 'Observation language and theoretical language' in *Rudolf Carnap, logical empiricist*, 1975) was based on the analytic-synthetic distinction. Carnap's method (i) explains the meaning of theoretical terms and their relationships with observational concepts, (ii) gives

a method for separating synthetic and analytic sentences and (iii) gives a method for dividing theoretical axioms from rules of correspondence. Roughly speaking:

- A syntactic characterization of the rules of correspondence was given: if A is the conjunction of all axioms and R is the Ramsey sentence, that R --> A is the only rule of correspondence (R --> A is called Carnap sentence).
- Analytic statements are logical consequence of Carnap sentence.
- Synthetic statements are logical consequence of Ramsey sentence.

There is an explicit assumption in logical positivism's analysis of science: a theory is a deductive system. This means that pragmatic aspects are not considered. Moreover, neopositivism was not interested in the real process of discovering, but it was concerned with the rational reconstruction of scientific knowledge, that is it dealt with logical (formal) relationships between statements in a given theory. According to logical positivism, there is not any method of discovering, and therefore a scientist can propose every hypothesis he prefers; only logical relationships between the hypothesis and the given empirical evidence are relevant. But there were some problems with this conception of science. First of all, the relation between empirical experience and theoretical principles is not a deductive one: observational statements do not imply theoretical axioms. Carnap argues that the relation is explicable with the help of the inductive logic. So we now must speak about inductive logic and probability.

There were two different theories about probability proposed by neopositivists:

- Frequency interpretation: the probability is the limit of a frequency. This theory is the preferred one in modern science and was formulated by Reichenbach and von Mises.
- Logical interpretation: the probability is the degree of confirmation a statement receives from a given set of other statements. Carnap, Hempel and Waismann were supporters of this hypothesis.

According to Reichenbach and von Mises, the meaning of a statement like 'the probability of P given Q is *r*' is that the limit of the relative frequency of objects P in the set of objects Q is *r*. That is, in a large sample of the set Q -- say *m* objects Q, where *m* is great -- there are *n* objects P, and $\lim(n/m)=r$, where *m* tends to infinity. Therefore Reichenbach asserted that a statement about the probability of a single event is meaningless.

Waismann proposed a logical interpretation of probability in his work 'Logische Analyse des Wahrscheinlichkeitsbegriffs' in *Erkenntnis*, 1, 1930. His starting-point is Wittgenstein's interpretation of probability. According to Waismann, we have to use the theory of probability when we do not know whether a proposition is true or false. In that circumstance, we can study the logical relationships between the statements that express our knowledge and we can determine their relative probability. Hence a probability is a mathematical measure of a logical relationship between propositions. What is the role of frequency in the logical interpretation? First of all, it is possible that we know so little about a physical condition that we can determine the probability only a posteriori by means of the frequency. Therefore the relative frequency and the logical probability are obviously equal. In other circumstances,

we can predict the probability through our knowledge of the relevant conditions and physical laws. In such situation, the frequency is used to verify the forecast.

Carnap was very interested in the problem about the probability of a single event. According to his interpretation the statement 'the probability that this single object P were Q is *r*' is a genuine statement. Its meaning is 'the statement "this single object P is Q" has a degree of confirmation *r*'. When *r*=1, the statement is true; when *r*=0 the statement is false; otherwise the statement has a certain portion of truth. Thus inductive logic, which is the study of logical relationships between statements whose degree of confirmation is different from 0 and 1, is an extension of classical logic and it is analytic, ie formal. So, according to Carnap, inductive logic explains the relationship between observational and theoretical statements. However, there is a great difficulty in that theory. The degree of confirmation of every universal law is always 0, for a universal law is a statement about a possibly infinite number of objects while every sample is finite. Hence the degree of confirmation of every scientific law with respect to every given experience is always 0. Another difficulty arose when Hempel formulated the so-called paradoxes of confirmation, according to which every universal law is supported by an apparently irrelevant evidence; for example, 'all ravens are black' is confirmed by the observation of a white shoe (see Hempel for further details).

Another consequence of the verifiability principle is that statements about ethical principles are neither true nor false; they are expressions of feeling (this theory is called noncognitivism). Therefore a theory of ethics is impossible. But if ethics is meaningless, a question rises: what is the origin of ethical principles? Among neopositivists, Schlick was the most interested in ethics; he endeavoured to give an account of ethics which was compatible with neopositivist philosophy. According to Schlick, ethics is a descriptive scientific theory. A man always prefers those conditions that do not produce pain or produce pleasure; thus, in a first time, good is whatever that gives pleasure and no pain. Good is thus equivalent to beneficial. Man's actions are caused by a wish to benefit himself. So the first ethical impulse is an egoistic one. But the motivations to act are not static: they are subjected to the natural evolution and selection. In a society, it is possible that an altruistic way of action is more beneficial that a purely egoistic one. So there is a contrast between the very first impulse, which suggests an egoistic behaviour, and the tendency to act generated by the evolution, which suggests a social behaviour. This is the origin of ethical principles.

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Before the Logical Positivism

What are the main philosophical and scientific outcomes that influenced the rise of logical positivism?

First of all, the theory of relativity exerted a great influence on logical positivism. Einstein's analysis of the empirical meaning of scientific concepts gave rise to the verifiability principle. The first published work on the special theory of relativity (Einstein's article 'Elektrodynamik bewegter Körper' in *Annalen der Physik*, 17, 1905) begins with a discussion on simultaneity and length which is one of the most

rigorous application of the verifiability principle -- about twenty years before Schlick's formulation. Moreover, the first Carnap's work was an essay about the theory of space published in 1922; Reichenbach attended Einstein's lectures on the theory of relativity at Berlin in 1917 and wrote in 1920s four books on that theory; Schlick wrote in 1915 and 1917 two essays on relativity.

Another great influence on logical positivism was exerted by the development of formal logic. Carnap attended three courses on logic under the direction of G. Frege, the father of modern logic; from a philosophical point of view, Frege asserted that all arithmetic statements are analytic a priori, and thus he denied the existence of synthetic a priori statements in arithmetic -- note that for Frege geometry is synthetic a priori, because it is not reducible to logic; therefore, in Frege's opinion, analytic statements are those that are logically true. K. Gödel, the logician who proved the completeness of first order logic and the incompleteness of arithmetic, was a member of the Vienna Circle. Logical positivism had extensive contacts with the group of Polish logicians who developed several branches of contemporary logic. Polish philosophy was greatly influenced by Kazimierz Twardowski (1866-1938), who studied at Vienna and taught at Lwow; he is the founder of Polish analytic philosophy. He taught to several Polish philosophers and logicians; among them were:

- Jan Lukasiewicz (1878-1956), who developed both the algebra of logic and a many-valued propositional calculus, which influenced Carnap's inductive logic (which was proposed as an extension of classical logic dealing with infinite-valued truth function) and Reichenbach's interpretation of quantum physics, in which Reichenbach employed a three-valued propositional calculus.
- Stanislaw Lesniewski (1886-1939), who was interested in the logical antinomies.
- Kazimierz Ajdukiewicz (1890-1963), who taught philosophy of language, epistemology and logic.
- Tadeusz Kotarbinski (1886-1981), who asserted that many alleged philosophical problems in fact are scientific problems, that is they are the object of empirical science and not of philosophy, which deals with logical and ethical problems only.

Lukasiewicz and Ajdukiewicz published several essays in *Erkenntnis*, the journal of the logical positivism, edit by Carnap and Reichenbach. Alfred Tarski (1902-1983), who developed the theory of semantics in a formal language, took part to the congresses on scientific philosophy organized by Vienna and Berlin Circle; he greatly influenced Carnap's philosophy of language -- in a first time, Carnap was interested in logical syntax but, after the publication of Tarski's works, he turned to semantics.

Italian mathematician Giuseppe Peano (1858-1932) indirectly influenced the logical researches of neopositivists. He developed a logical symbolism adopted by Russell, now widely used. He proposed five axioms as a definition of the set of natural numbers. Gödel proved the incompleteness theorem with respect to Peano's axiomatization.

Bertrand Russell's (1872-1970) mathematical logic exerted a major influence on logical positivism.

Russell asserted the analytic character of the whole mathematics; he endeavoured to prove this assumption in his works *Principles of mathematics*, 1903, and *Principia mathematica*, 1910-13 (the last written with A. N. Whitehead). *Principia mathematica* is a skilful application of logic to mathematics, which gave rise to endless philosophical and technical researches.

Ernst Mach (1838-1916) -- physicist and philosopher, he taught physics at the University of Prague and theory of inductive science at Vienna -- is often regarded as a great source of inspiration to logical positivism (the official name of the Vienna Circle was Verein Ernst Mach, ie Ernst Mach Association). He was a radical empiricist, critized the absolute theory of space and time, published a philosophical and historical analysis of classical mechanics, and formulated the principle of economy of thought, according to which scientific theories are useful tools to make predictions, but they do not reflect an objective and independent reality. Mach's influence on early logical positivism is unquestionable. However, I will remark upon some differences between Mach and logical positivism.
Mach was an anti-realist: there is nothing but our sensations; on these grounds, he never accepted the reality of atoms. This extreme anti-realism was not congenial to logical positivists. Schlick, at least in the first stage of his philosophical development, was a realist: science give us a true description of an external world; he professed his admiration for Mach, but also asserted that Machian anti-realism was too extreme and did not correctly depict the real activity of scientists. According to Carnap, the whole question is about preferred mode of speech -- it is a question about language. In fact -- said Carnap -- realism and anti-realism are meaningless; obviously scientific theories are useful tools, but their language includes true or false genuine statements. It must be noted that Schlick, under the influence of Wittgestein's *Tractatus*, eventually asserted that only statements without quantifiers are meaningful and thus scientific laws are not statements, but they are rules of inference, prescriptions to make forecasts -- so Schlick partially rejected his realism and accepted an interpretation of scientific laws similar to Machian economy of thought.

> The fundamental thesis of modern empiricism consists in denying the possibility of synthetic a priori knowledge.
> (H. Hahn, O. Neurath, R. Carnap, *Wissenschaftliche Weltauffassung. Der Wiener Kreis*, 1929).

This statement shows the attitude of logical positivism towards Kantian philosophy. However, Kant was regarded as the last traditional philosopher interested in epistemology who, at the same time, had a scientific competence. Neopositivists dedicated several pages to disprove the Kantian theory of space and time, while nothing was said about such a philosopher as Hegel -- it is symptomatic of the importance they attributed to Kant. Among Reichenbach's teachers was neokantian philosopher Ernst Cassirer -- who wrote an essay on the theory of relativity in 1921 and on quantum physics in 1936 -- while Carnap wrote his dissertation under the direction of neokantian Bruno Bauer.

Wittgenstein's *Tractatus Logico-Philosophicus* exerted a great influence on Vienna Circle; many meetings were dedicated to a punctual analysis of that work. Not all neopositivists' reactions to *Tractatus* were positive: according to Neurath it was full of metaphysics. Carnap (in his Autobiography

published in *The philosophy of Rudolf Carnap*) said that Wittgenstein's influence on Vienna Circle was overestimated. Moreover, Wittgenstein did not take part to Vienna Circle's discussions; there were separate meetings between him, Schlick, Carnap and Waismann, but soon Carnap was not admitted to those meetings. Wittgenstein's influence is evident in the formulation of the verifiability principle. See for example Proposition 4.024 of *Tractatus*, where Wittgenstein asserts that we understand a proposition when we know what happens if it is true and compare with Schlick's assertion 'The definition of the circumstances under which a statement is true is perfectly *equivalent* to the definition of its meaning'. Wittgenstein influenced also the interpretation of probability. He asserted that every statement is a truth function of its atomic statements; for example, (A ∨ B) is a statement whose truth depends on the truth of its atomic components A and B, according to the following truth-table.

A	**B**	**A ∨ B**
T	T	T
T	F	T
F	T	T
F	F	F

Now suppose we know (A ∨ B) is true and we want to know whether A is true. In the first, second and third row of the truth-table (A ∨ B) is true. In two of those rows A is true too. So there is a probability 2/3 that A is true. That is, the probability of A given (A ∨ B) is 2/3. The probability is thus a logical relation between two statements. It is very simple to find the probability of a statement P with respect to another statement Q. First of all, we write the truth-table of Q and count the rows where Q is true; suppose they are *m*. Among them, we count the rows where P is true, say *n*. The probability of P with respect to Q is thus *n*/*m*. This theory was accepted and used by Waismann ('Logische Analyse des Wahrscheinlichkeitsbegriffs' in *Erkenntnis*, 1, 1930). Waismann's work gave rise to an intense discussion with the Berlin Circle whose members -- namely von Mises and Reichenbach -- supported a frequency interpretation. Note also that this procedure is suitable only when the statements are not universal, that is P and Q must be statements without quantifiers. Really in *Tractatus* Wittgenstein argued that only simple propositions without quantifiers are meaningful. This point influenced Schlick's analysis of scientific laws.

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Early Researches in Europe

A very important year in the history of the logical positivism was 1922: in that year Schlick moved from Prague to Vienna, where he held the chair of theory of inductive science. At that time, Schlick had already published several philosophical works which heralded the new philosophical point of view: *Raum und Zeit in der gegenwärtingen Physik*, 1917 (English translation: *Space and time in contemporary physics*, 1920) and *Allgemeine Erkenntnislehre*, 1918 (English translation: *General*

theory of knowledge, 1974); also Reichenbach had already published *Relativitatstheorie und Erkenntnis apriori*, 1920 (English translation: *The theory of relativity and a priori knowledge*, 1965), a philosophical analysis of the theory of relativity against Kantian philosophy. Moreover, Hahn, Frank and Neurath had begun their meetings on philosophy of science in 1907. Why was the coming of Schlick in Vienna so important?
Schlick soon organized a discussion group and established relations with other philosophers of science and so the Vienna Circle took shape. Schlick called Carnap to Vienna and in 1926 Carnap became assistant professor under Schlick. Vienna Circle joined up with Berlin Circle (a similar group of philosophers of science that gathered round Reichenbach). Vienna Circle took many initiatives: among them, the publication of two series dedicated to the new philosophy of science; the journal *Erkenntnis*; the organization of several congresses on epistemology and philosophy of science.

Between 1924 and 1936 (in that year Schlick was murdered) there were many philosophical outcomes which gave shape to logical positivism. The verifiability principle was formulated; metaphysics was ruled out as not verifiable. Reichenbach published extensive analyses on the theory of relativity. Carnap was primarily interested in logical analysis of science, and he gave the first logical formulation of the verifiability principle. Wittgestein's *Tractatus* was discussed in Vienna Circle's meetings. Other philosophers were attracted by the new movement: Hempel studied with Reichenbach, Schlick and Carnap; Italian philosopher Geymonat went to Vienna and studied with Schlick and Carnap; American philosophers were interested in logical positivism; Morris and Quine went to Prague to meet Carnap; Polish logicians Ajdukiewicz and Lukasiewicz contributed essays to *Erkenntnis*; Popper published his *Logik der Forschung* in Vienna Circle's series.

In early 1930s logical positivism was an influential philosophical movement, known in USA and Europe; its members taught in many European universities and one of them (Feigl) in an American university. Logical positivism was not only interested in pure philosophical research, but also in political and educational activity. The ideas of its members were progressive, liberal and sometimes socialist. But in 1933 Hitler became Chancellor of Germany; Nazism was hostile towards neopositivism. In few years, many logical positivists were forced to emigrate; two of them (Schlick and Grelling) were murdered. USA became the new home for Carnap, Feigl, Frank, Gödel, Hempel and Reichenbach, while Neurath and Waismann sought refuge in England.

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The American Period

The spread of logical positivism in USA became in early 1930s. In 1929 and in 1932 Schlick was Visiting Professor at Stanford, while Feigl emigrated to USA in 1930, where he became lecturer (1931) and professor (1933) at the University of Iowa and afterwards at the University of Minnesota (1940). In 1932 the American Philosophical Association organized a discussion on the philosophy of logical positivism. In the same years several articles about logical positivism were published in American philosophical journals; among them were:

- E. Nagel, 'Nature and convention' in *The Journal of Philosophy*, 26, 1929, in which Nagel discussed Reichenbach's interpretation of the theory of relativity.
- S. Hook, 'Personal impression of contemporary German philosophy' in *The Journal of Philosophy*, 27, 1930, a favourable report on logical positivism.
- A. E. Blumberg and H. Feigl, 'Logical positivism. A new movement in European philosophy' in *The Journal of Philosophy*, 28, 1931.
- C. I. Lewis, 'Experience and meaning' in *The Philosophical Review*, 43, 1934, a critical article on the verifiability principle.
- M. Schlick, 'Meaning and verification' in *The Philosophical Review*, 45, 1936, a reply to Lewis.

In 1936 Schlick was murdered by a Nazi student at the University of Vienna. Between 1936 and 1940 several German and Austrian philosophers emigrated to USA: Carnap moved in 1936 to the University of Chicago, Reichenbach in 1938 to UCLA, Frank in 1938 (he became professor at Harvard University in 1939), Hempel in 1939 (City College of New York and in 1940 Queens College), Gödel in 1940 (Institute for Advanced Study at Princeton).

Logical positivists found a favourable terrain in USA. They established solid relationships with American pragmatism; particularly Charles Morris took part to several neopositivist's projects. One of them was the *International Encyclopedia of Unified Science*, primarily promoted by Neurath. Although the original project was never fully realized, many works were indeed published.

For an analysis of the outcomes of logical positivists' researches, you can view Carnap, Hempel and Reichenbach; they were the most active and influential representatives of logical positivism. Now I shall briefly precise some lines of research.

Roughly speaking, there were four different fields of interest.

- Philosophy of physics, mainly performed by Reichenbach and Frank. The former wrote about theory of relativity, quantum physics, philosophy of time; the latter wrote a biography of Einstein and an analysis of the theory of relativity.
- Theory of probability and inductive logic, a field in which Carnap made many works.
- Logical analysis of the structure of a scientific theory and its language. There were works of Hempel and Oppheneim on scientific explanation and confirmation; of Hempel and Carnap about concept formation in empirical science; a strenuous defence of the dichotomy between analytic and synthetic statements, due to Carnap, who also proposed several formal versions of the verifiability principle. General treatises were published by Braithwaite, Carnap, Hempel, Nagel.
- Finally, Carnap wrote several works on both classical and modal logic and about semantics.

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Influences on European Philosophy

I have already depicted the relations between logical positivism and Polish philosophy; I must say that Polish philosophy greatly influenced logical positivism. In twentieth century, Polish philosophers were very interested in logical problems; their works contributed to the development of several branches of logic, such as semantics and many-valued logic. Polish logicians analyzed logical aspects of neopositivist philosophy. Marian Przelecki's work *The logic of empirical theories*, 1969, is a good example of such studies. In his work, Przelecki examined the logical structure of theories and proposed a semantic model of a formalized language suitable for a scientific theory. He used a relatively simple extension of Tarskian classical semantics. In his theory not all statements are true or false: a proposition can be indeterminate, that is neither true nor false (but the law of excluded middle is always true). Therefore there is at least a statement, say P, so that (i) P is not true; (ii) P is not false and (iii) Pv~P is true. A very interesting property of Przelecki's semantics is the following one. Let Ax be the set of axioms of a scientific theory and suppose that Ax is finite; let A be the conjunction of all statements in Ax. It is possible that A is false even if every statement in Ax is not false (ie, the conjunction of a finite number of assertions can be false even if every assertion is not false). This property is very useful in explaining a well-known situation: when a theory is proved false, it is often very difficult to determine the wrong axiom. Another outcome of Przelecki's theory is a semantic characterization of the rules of correspondence. It was proved that Carnap sentence is the weakest rule of correspondence, but it is not the only possible one. For example, suppose the following two statements are the only axioms in Ax:

$$(x)(O_1x \dashrightarrow T_1x)\ ,\ (x)(O_2x \dashrightarrow \sim T_1x)$$

O_1, O_2 are observational terms and T_1 is a theoretical term. Every one of the following statements is an admissible rule of correspondence:

$$(x)[(O_1x \vee O_2x) \dashrightarrow (T_1x \leftdashrightarrow O_1x)]$$
$$(x)[\sim(O_1x \,\&\, O_2x) \dashrightarrow ((O_1x \vee O_2x) \dashrightarrow (T_1x \leftdashrightarrow O_1x))]$$
$$(x)\sim(O_1x \,\&\, O_2x) \dashrightarrow (x)[(O_1x \vee O_2x) \dashrightarrow (T_1x \leftdashrightarrow O_1x)]$$

The last statement is logically equivalent to Carnap sentence. Finally, a sentence S is analytic if and only if it is a logical consequence of the set of rules of correspondence; S is contradictory if and only if ~S is analytic; S is synthetic if and only if it is neither analytic nor synthetic.

English philosopher Alfred Jules Ayer (1910-1989) played an important role in the spreading of logical positivism. His work *Language, Truth and Logic*, 1936, gained an immediate success. In that book, Ayer completely accepted both the verifiability principle and the distinction between analytic and synthetic statements; hence he asserted that metaphysical sentences are meaningless. A direct influence was exerted by Waismann and Neurath who emigrated in England in 1937 and 1940 respectively. Waismann taught at Cambridge and, from 1939 to 1959, at Oxford, where he taught philosophy of mathematics and philosophy of science. During this period Waismann was very interested in the

philosophy of Wittgenstein.

Relations between Italian philosophy and neopositivism arose in the early stages of logical positivism. Italian mathematician and philosopher of science Federigo Enriques (1871-1946) took part to the congresses on scientific philosophy and collaborated on the *International Encyclopedia*; Neurath and Carnap contributed articles to the journal *Scientia* edit by Enriques. In 1934 Ludovico Geymonat (1908-1991) published a work on logical positivism: *La nuova filosofia della natura in Germania*. Geymonat had the opportunity to study with Schlick, Reichenbach, Carnap and Waismann; later he held the first chair in Italy of philosophy of science (1956). However, the interest of Italian philosophy on logical positivism was primarily directed towards historical researches. Francesco Barone distinguished himself by his work *Il neopositivismo logico*, 1953, a detailed and up to date historical and philosophical analysis of logical positivism, that deserves mention for it focuses attention not only on Vienna Circle but also on the American period of logical positivism and on some philosophers sometimes forgotten (even now it is not impossible to find valuable dictionaries of philosophy that identify logical positivism with the Vienna Circle).

French philosophy was marginally interested in logical positivism. Charles E. Vouillemin translated several neopositivist's works and, in 1935, published *La logique de la science et l'ecole de Vienne*, a book in which he examined the philosophy of the Vienna Circle. Luis Rougier (1889-1982) gave reports about logical positivism ('Une philosophie nouvelle: l'empirisme logique' in *Reveu de Paris*, 63, 1935), collaborated on the *International Encyclopedia of Unified Science* and contributed works to *Erkenntnis*.

As early as 1930 Scandinavian philosophers were interested in logical positivism. Two of them, Swedish Ake Petzäll (1901-1957) and Finnish Eino Kaila (1890-1958), employed for the first time the expression 'logical neopositivism' for denoting the new philosophical movements (A. Petzäll, *Der logistische Neupositivismus*, 1930 and E. Kaila, 'Der logistische Neupositivismus' in *Annales Universitatis Aboensis*, ser. B, 13, 1930). Petzäll was mainly influenced by the Vienna Circle and in 1930-31 he went to Vienna, where he took part to Vienna Circle's meetings. Later (1935) he founded a new journal, *Theoria*, published in Göteborg; in that journal Hempel published his very first description of the paradoxes of confirmation ('Le problème de la vérité', 3, 1937). Eino Kaila published in 1939 a work pervaded by the principles of logical positivism (*The human knowledge*, in Finnish). He taught philosophy at the University of Helsinki. Among his students was George Henrik von Wright (b. 1916) who published a study about logical positivism (*The logical empiricism*, 1943, in Finnish). Wright contributed to the development of both modal and deontic logic. Finnish Jaakko Hintikka (b. 1929) -- among his teachers was Wright -- pursued Carnap's studies on inductive logic. Hintikka's article 'A two-dimensional continuum of inductive methods' in *Aspects of inductive logic* (ed. by J. Hintikka and P. Suppes), North Holland Pub. Co., 1966, extended the methods Carnap used in *The continuum of inductive methods*, 1952. Roughly speaking, Carnap defined a system of inductive logic in which there is a one-to-one correspondence between the function that gives the degree of confirmation of a statement and the function that gives the estimated relative frequency. The exact relationship between these two functions depends on only one parameter Carnap called *lambda*; it can assume all real values between 0 and infinity (thus the system is a continuum of inductive methods). Every value of *lambda*

defines a different methods for evaluating the degree of confirmation. However, the probability of an universal law is always 0. Hintikka added a second parameter he called *alfa* so that the system became a two-dimensional continuum. When *alfa* = infinity Hintikka's system is identical with Carnap's one-dimensional system. Otherwise the two-dimensional system gives a reasonable degree of probability to universal laws even in an infinite universe.

Danish philosopher Joergen Joergensen (1894-1969) very actively collaborated with neopositivists. After Hanh's death (1934) he became an editor of the Vienna Circle's series *Einheitswissenchaft*; later he collaborated on the *International Encyclopedia* to which he contributed the essay *The development of logical empiricism*, 1951.

Finally, it must be noted that logical positivism played a very important role in the development of contemporary philosophy not only for its philosophical principles, but also for its editorial and organizational activities. It is not superfluous to remember that Popper and Kuhn published their most known and seminal works in neopositivist's series. This fact do not prove that Popper and Kuhn were neopositivists; but it shows the broad-mindedness, the kindly disposition and the lasting influence of logical positivism.

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Biographical Notes

Herbert Feigl (Reichenberg, Austria, but now in Czech, 1902 - 1988). Philosopher of science. In 1921 he studied physics and chemistry at the University of Munich and in 1922 moved to Vienna, where he was an early member of the Vienna Circle. At Vienna he studied mathematics, philosophy, physics and psychology, and received his degree in philosophy in 1927. In 1929 he met K. R. Popper whose ideas he found interesting, so he encouraged Popper to write a book which became the *Logik der Forschung*. In 1930 Feigl emigrated to USA. His article (written with A. E. Blumberg) 'Logical positivism. A new movement in European philosophy' in *The Journal of Philosophy*, 28, 1931, was one of the first reports on logical positivism published in USA and promoted the spread of logical positivism. Between 1931 and 1940 he taught at the University of Iowa and from 1940 at the University of Minnesota, where in 1953 he founded the Minnesota Center for Philosophy of Science, the oldest center for philosophy of science in the World. Between 1966 and 1973 he was president of the Institute of the Unity of Science. Feigl supported a materialistic theory of mind -- the identity theory of mind -- according to which mental events are identical with states in the brain ('The mind-body problem in the development of logical positivism' in *Revue International de la Philosophie*, 4, 1950; 'The Mental and the Physical' in *Minnesota studies in the philosophy of science*, II, 1958).

Philipp Frank (Vienna 1884 - Cambridge, Mass. 1966). Physicist and philosopher of science. He studied at Gottingen with David Hilbert and Felix Klein and at Vienna, where he received (1907) his degree in physics under the direction of Ludwig Boltzmann. In the same year Hahn, Frank and Neurath began their meetings in a Viennese café, where they discussed about the new philosophy of science and

epistemology -- Mach, Poincaré, Duhem. In 1912 he held the chair of theoretical physics at the German University of Prague. Frank was an editor of series *Schriften zur wissenschaftlichen Weltauffassung* and *Einheitswissenschaft*. He moved to USA in 1938 where he taught physics and philosophy of science at Harvard University. His work *Foundations of physics* was published in 1946 in the *International Encyclopedia of Unified Science*. From 1949 to 1966 he was president of the Institute of the Unity of Science. He wrote several essays on philosophy of physics: *Between physics and philosophy*, Cambridge, Mass., 1941; *Einstein: his life and time*, New York, 1953; *Relativity: a richer truth*, Boston, 1950.

Kurt Grelling (1886 - ?). Logician and philosopher. He was a victim of Nazist persecution and it is supposed that he died with his wife in Auschwitz concentration camp during 1942, although it has been also reported that Grelling was killed in 1941 at the border between France and Spain while he was trying to escape in Spain. Hempel remembers that Oppenheim made every effort to allow Grelling to immigrate in USA but -- according to Hempel -- immigration officials were perplexed by an alleged Grelling's propensity towards Communism; so there was a delay that was fatal to Grelling, who was captured in France and killed in a Polish concentration camp. The episode is reported in Hempel, 'Autobiografia intellettuale' in *Oltre il positivismo logico*, Armando : Rome, 1988 (this essay is the text of an interview Hempel gave to Richard Noland in 1982, published for the first time in Italian translation in 1988).
Grelling was a teacher in secondary school and was interested in logical problems. A semantic paradox is named after him, the Grelling's paradox, formulated in 1908 by Grelling and Leonard Nelson. There are some words which have the property they express; for example 'short' is short. Those words are called autological. The other words are called heterological; for example, 'long' is an heterological word -- it is not long. Now the question is whether 'heterological' is heterological. If yes, then 'heterological' is by definition an autological word and thus it is not heterological. If no, then 'heterological' has the property it designate and therefore it is heterological. Thus, 'heterological' is heterological if and only if it is not heterological.
Grelling collaborated with Gödel and in 1936 he published an article in which he defended Gödel's theorem of incompleteness against an erroneous interpretation, according to which Gödel's theorem is indeed a paradox like Russell's paradox ('Gibt es eine Gödelsche Antinomie?' in *Theoria*, 3, 1936). Grelling was also interested in the analysis of scientific explanation and in Gestalt approach.

Hans Hahn (Vienna 1879 - Vienna 1934). Mathematician and philosopher, co-author of the manifesto of the Vienna Circle. He received his degree in mathematics in 1902; afterwards he studied under the direction of Boltzamm in Vienna and Hilbert, Klein, Minkowski in Gottingen. In 1905 he taught mathematics at Innsbruck and in 1909 at the University of Vienna. In 1907 Hahn, Frank and Neurath began their meetings on philosophy. Later, in 1922, they arranged to bring Schlick to the University of Vienna. After the First World War -- during which he taught in Bonn -- Hahn returned to the University of Vienna (1921). He held courses on the symbolic logic, the foundations of mathematics and Wittgenstein's *Tractatus*; one of the students who attended Hahn's courses was K. R. Popper, who found his lectures very interesting and of perfect clarity. Another his student was Kurt Gödel, who wrote his dissertation, in which he proved the completeness of first order logic, under Hahn's direction. Hahn was and editor of the series *Einheitswissenschaft*.

Carl Gustav Hempel (1905 - 1997). See Hempel.

Otto Neurath (Vienna 1882 - Oxford 1945). Philosopher and sociologist. He played an important role in the development of logical positivism; very active, he took part to the meetings with Frank and Hahn from 1907, arranged -- with Hahn and Frank -- to bring Schlick to the University of Vienna in 1922, was a co-author of the manifesto of the Vienna Circle (it is supposed that Neurath was indeed the principal author), planned and directed the *International Encyclopedia of Unified Science*, was an editor of the journal *Erkentnnis* and of the series *Einheitswissenchaft*, founded and directed the International Foundation for Visual Education. Neurath studied economy, sociology and philosophy at the University of Vienna and at the University of Berlin. In 1919 he was member of the government of the socialist republic of Bavaria; he was imprisoned and prosecuted, but he managed to escape in Vienna, where was director of a museum from 1924 to 1934. In that year Neurath emigrated to Holland and in 1940 he moved to England, where he died in 1945.
Neurath proposed a linguistic theory of science, according to which scientific statements are not judged by means of the empirical evidence, but they are verified with respect to all other statements: true is thus replaced with coherence.

> When a statement is formulated, it is checked against the totality of existing statements. If it agrees with them, it is accepted; otherwise, it is marked as not true ... there is no other criterion of truth.
> ('Physikalismus', in *Scientia*, 50, 1931).

According to Neurath, the unity of science is attainable through the unity of language. Neurath regarded the language of physics as the only legitimate and objective language which completely avoids the problems (eg solipsism) generated by a phenomenalistic language (it is evident a criticism to the methodological solipsism Carnap used in his *Der logische Aufbau der Welte*). In the language of science there is no room for ethical terms (ethics is meaningless). But also psychological concepts are forbidden; we must substitute them with physical concepts.
Neurath also proposed an international picture language, the Isotype (*International picture language, the first rules of Isotype*, London, 1936; *Basic by Isotype*, London, 1937; *Modern man in the making*, London, 1939). This visual language was based on a combination of charts, graphics, diagrams, maps. The original project of the *International Encyclopedia* included a never realized Visual Thesaurus in several volumes written in Isotype. Now we can fully appreciate the utility of a visual representation based on graphics, icons, etc; thus we can also appreciate Neurath's prophetic intuition of an international visual language.

Hans Reichenbach (1891 - 1953). See Reichenbach.

Moritz Schlick (Berlin 1882 - Vienna 1936). Physicist and philosopher. He studied at the University of Losanna, Heidelberg and Vienna, where he received his degree in physics with a dissertation written under the direction of Max Planck. Between 1911 and 1917 he taught at the University of Rostock. In

those years Schlick was interested in the theory of relativity; he wrote 'Die philosophische Bedeutung der Relativitätsprinzip' in *Zeitschrift für Philosophie und philosophische Kritik*, 159, 1915; *Raum und Zeit in der gegenwärtingen Physik*, Berlin, 1917 (English translation: *Space and time in contemporary physics*, 1920). In 1918 he published *Allgemeine Erkenntnislehre* (English translation: *General theory of knowledge*, 1974). With the help of Frank, Hahn and Neurath, in 1922 Schlick moved to the University of Vienna, where he held the chair of theory of inductive science. Schlick organized a discussion group known as the Vienna Circle. He was an editor of the series published by the Vienna Circle *Schriften zur wissenschaftlichen Weltauffassung*. In 1929 and 1932 he was Visiting Professor at Stanford University; he was the herald of the philosophy of logical positivism in USA. The American journal *Philosophical Review* hosted an interesting exchange of opinions between American philosopher C. I. Lewis and Schlick on the verifiability principle (C. I. Lewis, 'Experience and meaning', 1934; M. Schlick, 'Meaning and verification', 1936). In 1929, the manifesto of the Vienna Circle, written by Hahn, Neurath and Carnap, was dedicated to Schlick; in 1930 the first article published in the new journal *Erkenntnis* was Schlick's *Die Wende der Philosophie*.
Schlick was killed in the University of Vienna by a Nazi sympathizer student on June 22 1936.
Schlick can be regarded as the father of logical positivism, both for his organizational skills and for his philosophical ideas. He formulated the verifiability principle.
According to Schlick, scientific laws are not genuine statements, for they are not completely verifiable; they are rules employed to make predictions. The only criterion for justifying scientific laws is the reliability of forecasts; causal laws express nothing but the possibility to make a prediction. Quantum physics has proved -- Schlick asserted -- that there is a limit to such a possibility. That limitation is not due to a failure of human knowledge or to an interference the human observer cause on the physical system. If quantum mechanics proves the impossibility of a simultaneous measurement of position and momentum, therefore -- according to Schlick -- simultaneous position and momentum do not exist.
Schlick criticized Neurath's linguistic theory of science. According to Schlick, science is not characterized by the internal coherence: scientific statements must be tested with respect to the given experience.

Friedrich Waismann (1896 - Oxford 1959). Philosopher. He studied mathematics and philosophy at Vienna and in 1929 became assistant to Schlick. He was one of the few members of the Vienna Circle admitted to the meetings with Wittgenstein. Waismann recorded several conversations whose text was published posthumously in F. Waismann, *Wittgenstein und der Wiener Kreis*, 1967 (English translation *Wittgenstein and the Vienna circle : conversations recorded by Friedrich Waismann*, New York : Barnes & Noble Books, 1979). Waismann proposed a logical interpretation of probability inspired by Wittgenstein in his work 'Logische Analyse des Wahrscheinlichkeitsbegriffs' (*Erkenntnis*, 1, 1930). In 1936 he published his only book *Einführung in das mathematische Denken,* about the philosophy of mathematics. He emigrated to England in 1937, where he taught philosophy of mathematics and philosophy of science at Cambridge and, from 1940, at Oxford. In England he contributed to the development of analytic philosophy. Posthumously was published *The principles of linguistic philosophy*, Oxford, 1965, an exposition to the philosophy of the late Wittgestein.
The only book he published during his life dealt with the interpretation of mathematics. Waismann criticized both logicism and formalism. Logicism argues that all mathematical truths are logical truths and it is based on Frege and Russell definition of natural numbers: a natural number is the class of all

equinumerable classes. According to Waismann, this definition introduces an element of contingency in mathematics, thus disturbing its a priori character. Moreover, formal logic is by no means a privileged calculus to which all mathematics is reducible. Logic itself is a part of mathematics. Waismann also rejected the formalistic interpretation, because it is not interested with the meaning of mathematical concepts. For formalism, a natural number is whatever fulfils the axioms of mathematics. But this approach neglects a very important problem, that is the question whether the axioms of mathematics identify the natural number we really employ. The solution consists in the study of the role that natural numbers play in ordinary language (note the evident analogy with Wittgestein's assertion that meaning is use).

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Sources

International Encyclopedia of Unified Science.
(Publications are arranged in chronological order).

O. Neurath, N. Bohr, J. Dewey, B. Russell, R. Carnap, C. Morris, *Encyclopedia and unified science*, 1938, vol.1 n.1
C. Morris, *Foundations of the theory of signs*, 1938, vol.1 n.2
V. Lenzen, *Procedures of empirical sciences*, 1938, vol.1 n.5
R. Carnap, *Foundations of logic and mathematics*, 1939, vol.1 n.3
L. Bloomfield, *Linguistic aspects of science*, 1939, vol.1 n.4
E. Nagel, *Principles of the theory of probability*, 1939, vol.1 n.6
J. Dewey, *Theory of valuation*, 1939, vol.2 n.4
G. De Santillana and E. Zilsel, *The development of rationalism and empiricism*, 1941, vol.2 n.8
O. Neurath, *Foundations of social sciences*, 1944, vol.2 n.1
J. Woodger, *The technique of theory construction*, 1949, vol.2 n.5
P. Frank, *Foundations of physics*, 1946, vol.1 n.7
E. Frinlay-Freundlich, *Cosmology*, 1951, vol.1 n.8
J. Joergensen, *The development of logical empiricism*, 1951, vol.2 n.9
E. Brunswik, *The conceptual framework of psychology*, 1952, vol.1 n.10
C. Hempel, *Fundamentals of concept formation in empirical science*, 1952, vol.2 n.7
F. Mainx, *Foundations of biology*, 1955, vol.1 n.9
A. Edel, *Science and the structure of ethics*, 1961, vol.2 n.3
T. Kuhn, *The structure of scientific revolutions*, 1962, vol.2 n.2
G. Tintner, *Methodology of mathematical economics and econometrics*, 1968, vol.2 n.6
H. Feigl and C. Morris, *Bibliography and index*, 1969, vol.2 n.10

STUDIES ABOUT LOGICAL POSITIVISM.

ENGLISH

Achinstein, Peter and Barker, Stephen F., (ed.), *The Legacy of logical positivism; studies in the philosophy of science*, Baltimore : Johns Hopkins Press, 1969

Ayer, Alfred Jules (ed.), *Logical positivism*, Glencoe, Ill. : Free Press, 1959

Beckwith, Burnham Putnam, *Religion, philosophy, and science; an introduction to logical positivism*, New York : Philosophical Library, 1957

Bergmann, Gustav, *The metaphysics of logical positivism*, New York : Longmans, Green, 1954.

Boeselager, Wolfhard F., *The Soviet critique of neopositivism : the history and structure of the critique of logical positivism and related doctrines by Soviet philosophers in the years 1947-1967*, Dordrecht ; Boston : Reidel Pub. Co., 1975

Cirera, Ramon, *Carnap and the Vienna circle : empiricism and logical syntax*, Amsterdam ; Atlanta, GA : Rodopi, 1994.

Cornforth, Maurice Campbell, *Science versus idealism. In defence of philosophy, against positivism and pragmatism*, London : Lawrence & Wishart, 1955.

Gadol, Eugene T. (ed.), *Rationality and science : a memorial volume for Moritz Schlick in celebration of the centennial of his birth*, Wien : Springer, 1982.

Ganguly, Sachindranath, *Logical positivism as a theory of meaning*, Bombay, New York : Allied Publishers, 1967

Giere, Ronald N. and Richardson, Alan W. (ed.), *Origins of logical empiricism*, Minneapolis : University of Minnesota Press, 1997.

Gower, Barry (ed.), *Logical positivism in perspective : essays on Language, truth, and logic*, Totowa, N.J. : Barnes & Noble Books, 1987.

Gross, Barry R., *Analytic philosophy; an historical introduction*, New York : Pegasus, 1970

Hanfling, Oswald, *Logical positivism*, Oxford : B. Blackwell, 1981.

Jangam, R. T., *Logical positivism and politics*, Delhi : Sterling Publishers [1970]

Janik, Allan and Toulmin, Stephen, *Wittgenstein's Vienna*, London : Weidenfeld and Nicolson, 1973.

Joad, Cyril Edwin Mitchinson, *A critique of logical positivism*, Chicago : University of Chicago Press, 1950

Kraft, Victor, *The Vienna Circle; the origin of neo-positivism, a chapter in the history of recent philosophy*, New York, Greenwood Press, 1953

McGuinness, Brian, (ed.), *Wittgenstein and the Vienna circle : conversations recorded by Friedrich Waismann ; translated by Joachim Schulte and Brian McGuinness*, New York : Barnes & Noble Books, 1979.

von Mises, Richard, *Positivism, a study in human understanding*, Cambridge : Harvard University Press, 1951.

Nieli, Russell, *Wittgenstein : from mysticism to ordinary language : a study of Viennese positivism and the thought of Ludwig Wittgenstein*, Albany : State University of New York Press, 1987.

Qadir, Chaudhry Abdul, *Logical positivism*, Lahore, Pakistan Philosophical Congress, 1965.

Rahim, Syed Ataur, *Logical positivism and metaphysics : a defence of metaphysics against the logical positivists' criticisms*, Karachi : Rahim Publishers, 1990.

Rescher, Nicholas (ed.), *The Heritage of logical positivism*, Lanham, MD : University Press of America, 1985.

Richardson, Alan W., *Carnap's construction of the world : the 'Aufbau' and the emergence of logical empiricism*, Cambridge, U.K. ; New York : Cambridge University Press, 1997.

Sarkar, Sahotra (ed.), *Decline and obsolescence of logical empiricism : Carnap vs. Quine and the critics*, New York : Garland Pub., 1996.

Sarkar, Sahotra (ed.), *Logical empiricism and the special sciences : Reichenbach, Feigl, and Nagel*, New York : Garland Publ., 1996.

Sarkar, Sahotra (ed.), *Logical empiricism at its peak : Schlick, Carnap, and Neurath*, New York : Garland Pub., 1996.

Sarkar, Sahotra (ed.), *The emergence of logical empiricism : from 1900 to the Vienna circle*, New York : Garland Publishing, 1996.

Sarkar, Sahotra (ed.), *The legacy of the Vienna circle : modern reappraisals*, New York : Garland Pub., 1996.

Smith, Laurence D., *Behaviorism and logical positivism : a reassessment of the alliance*, Stanford, Calif. : Stanford University Press, 1986.

Tolman, Charles W. (ed.), *Positivism in psychology : historical and contemporary problems*, New York : Springer-Verlag, 1992.

Weinberg, Julius Rudolph, *An examination of logical positivism*, London : Kegan, 1936.

Zuurdeeg, Willem Frederik, *A research for the consequences of the Vienna Circle philosophy for ethics*, Utrecht: Kemink, 1946

FRENCH.

Feyerabend, Paul (et al.), *De Vienne a Cambridge : l'heritage du positivisme logique de 1950 a nos jours : essais de philosophie des sciences*, Paris : Gallimard, 1980.

Jacob, Pierre, *L'empirisme logique : ses antecedents, ses critiques*, Paris : Editions de Minuit, 1980.

Lecourt, Dominique, *L'ordre et les jeux : le positivisme logique en question*, Paris : B. Grasset, 1981.

GERMAN.

Belke, Felicitas, *Spekulative und wissenschaftliche Philosophie. Zur Explikation des Leitproblems im Wiener Kreis des Neopositivismus*, Meisenheim am Glan, Hain, 1966.

Brand, Karl, *Das Todesproblem in der Philosophie des 'Wiener Kreises'*, Essen : Verlag Die Blaue Eule, 1984.

Brand, Karl, *Asthetik und Kunstphilosophie im Wiener Kreis*, Essen : Blaue Eule, 1988.

Bruning, Walther, *Der Gesetzesbegriff im Positivismus der Wiener Schule*, Mainz, 1951.

Czapiewski, Winfried, *Verlust des Subjekts? : zur Kritik neopositivistischer Theorien*, Kevelaer : Butzon & Bercker, 1975

Dahms, Hans-Joachim, (ed.) *Philosophie, Wissenschaft, Aufklarung : Beitrage zur Geschichte und Wirkung des Wiener Kreises*, Berlin ; New York : De Gruyter, 1985.

Dahms, Hans-Joachim, *Positivismusstreit : die Auseinandersetzungen der Frankfurter Schule mit dem logischen Positivismus, dem amerikanischen Pragmatismus und dem kritischen Rationalismus*, Frankfurt am Main : Suhrkamp, 1994.

Danneberg, Lutz (ed.), *Hans Reichenbach und die Berliner Gruppe*, Braunschweig [u. a.] : Vieweg, 1994. - VII, 491 S. : graph. Darst. Literaturangaben

Durr, Karl, *Der logische Postivismus*, Bern : A. Francke, 1948.

Haeberli, Hans, *Der Begriff der Wissenschaft im logischen Positivismus*, Bern, P. Haupt, 1955.

Haller, Rudolf, *Neopositivismus : eine historische Einfuhrung in die Philosophie des Wiener Kreises*, Darmstadt : Wissenschaftliche Buchgesellschaft, 1993.

Horstmann, Hubert, *Der Physikalismus als Modellfall positivistischer Denkweise*, Berlin: Akademie-Verlag, 1973.

Kraft, Viktor, *Der Wiener Kreis, der Ursprung des Neopositivismus; ein Kapitel der jungsten Philosophiegeschichte*, Wien, Springer-Verlag, 1950.

Lindfors, Pertti, *Der dialektische Materialismus und der logische Empirismus: eine kritische und vergleichende Untersuchung*, Jyvaskyla : Universitat Jyvaskyla, 1978.

Morawitz, Adolf, *Logischer Empirismus und Politik im Wiener Kreis: eine Kontroverse*, Wien, Univ., 1996

Nemeth, Elisabeth, *Otto Neurath und der Wiener Kreis : revolutionare Wissenschaftlichkeit als politischer Anspruch*, Frankfurt ; New York : Campus, 1981.

Ruml, Vladimir, *Der logische Postivismus*, Berlin, Deutscher Verlag der Wissenschaften, 1965.

Schleichert, Hubert (ed.), *Logischer Empirismus, der Wiener Kreis : ausgewahlte Texte mit einer Einleitung*, Munchen : Fink, 1975.

Stadler, Friedrich, *Vom Positivismus zur 'wissenschaftlichen Weltauffassung' : am Beispiel der Wirkungsgeschichte von Ernst Mach in Osterreich von 1895 bis 1934*, Wien : Locker, 1982.

Tuschling, Burkhard und Rischmuller, Marie, *Kritik des logischen Empirismus*, Berlin : Duncker & Humblot, 1983.

Waismann, Friedrich, *Wittgenstein und der Wiener Kreis*, Frankfurt a. M., Suhrkamp, 1967.

ITALIAN.

Antiseri, Dario, *Dal neopositivismo alla filosofia analitica*, Roma : Edizioni ABETE, 1966

Barone, Francesco, *Il neopositivismo logico*, Roma ; Bari : Laterza, 1977.

Cases, Cesare, *Marxismo e neopositivismo*, Torino : Einaudi, 1958

Giacomini, Bruna, *Il valore dell'asserto di base nel neopositivismo*, Venezia : Istituto veneto di scienze, lettere ed arti, 1974.

Geymonat, Ludovico, *La nuova filosofia della natura in Italia*, Torino : 1934

Geymonat, Ludovico, *Studi per un nuovo razionalismo*, Torino, 1945

Guido, Cosimo, *Il problema educativo nel neopositivismo*, Lecce : Milella, 1968.

Parrini, Paolo, *Una filosofia senza dogmi : materiali per un bilancio dell'empirismo contemporaneo*, Bologna : Il mulino, 1980.

Parrini, Paolo, *Empirismo logico e convenzionalismo : saggio di storia della filosofia della scienza*, Milano : F. Angeli, 1983.

Pasquinelli, Alberto, *Il neoempirismo*, Torino : UTET, 1969.

Preti, Giulio, *Praxis ed empirismo*, Torino : Einaudi, 1975.

Trinchero, Mario, *Il neopositivismo logico*, Torino : Loescher, 1978

SPANISH.

Reexamen del neopositivismo, Salamanca : Sociedad Castellano-Leonesa de Filosofia, 1992. - Trabajos presentados en el 6 Encuentro de la Sociedad Castellano-Leonesa de Filosofia, 8-10 de noviembre de 1990.

Arminan, Fernardo Inciarte, *El reto del positivismo logico*, Madrid : Rialp, [1974]

Astrada, Carlos, *Dialectica y positivismo logico*, Tucuman : Universidad Nacional de Tucuman, Facultad de Filosofia y Letras, 1961.

Caso, Antonio, *Positivismo, neopositivismo y fenomenologia*, Mexico, : D.F., Centro de estudios filosoficos de la Facultad de filosofia y letras, 1941.

Cirera Duocastella, Ramon, *Carnap i el Cercle de Viena : empirisme i sintaxi logica*, Barcelona : Anthropos, 1990

Larroyo, Francisco, *El positivismo logico; pro y contra*, Mexico, Editorial Porrua, 1968.

Lopez i Carrera, Joan, *Positivismo y neopositivismo*, Barcelona : Vicens-Vives, 1989

Porta, Miguel, *El positivismo logico : el Circulo de Viena*, Barcelona : Montesinos, 1983.

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