# CHARLES S. PEIRCE AN INTELLECTUAL BIOGRAPHY

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# GÉRARD DELEDALLE

Translated from French and introduced by

SUSAN PETRILLI

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To Max Fisch, to whom Peirce studies owe so much. I wish to thank him here for the generosity with which he has always put at my disposal the unpublished results of his detailed research on Peirce's work.

For Janice and Myriame

# **Table of Contents**

On the Semiotics of Interpretation:	xi
Introduction by Susan Petrilli	
Foreword by Max H. Fisch	xxix
Presentation	xxxi
Introduction	1
Chapter one: Leaving the Cave (1851-1870)	5
1. From Nominalism to the Critique of Kantian Logic	5
2. A New List of Categories	7
3. Against the Spirit of Cartesianism: A New "Realist" Concep-	
tion of the Thought Process	11
4. Grounds of Validity of the Laws of Logic: The Nature of	
Reality and the Social Character of Logic	19
Chapter two: The Eclipse of the Sun (1870-1887)	23
1. Journeys and Professional Activities	23
2. Formation of the Logic of Relations and the New Conception	
of Propositions	24
3. Theory of Research	26
4. Mathematics and Symbolic Logic	36
- Boolian Logic	38
- Logic of Relatives and of Terms	39
- Propositional Logic	40
Truth Values	41
The Philonian Function	41
The System of Axioms	42
5. Discovery of Greek Cosmology	43
Chapter three: The Sun Set Free (1887-1914)	45
1. Arisbe	45
2. The system	46

3. Phenomenology	48
4. The normative sciences	52
- Esthetics and Ethics	52
- Logic	56
Semiotic	56
Formal Logic	58
Abduction, Induction, Deduction	60
5. Scientific Metaphysics	64
- Tychism	65
- Synechism	67
- Agapism	70
- God	71
Conclusion	73
Notes	75
Chronology	79
Bibliography	85
Index	87
Index nominum	
Index rerum	

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# On the semiotics of interpretation Introduction

Susan Petrilli

This book by Gérard Deledalle in both the original French edition (1987) as well as the present English edition, is particularly interesting for two main reasons: firstly, it constitutes a major contribution to the diffusion of the theories of Charles Sanders Peirce; secondly, it offers a special perspective in the critical interpretation of the latter's important pioneer work. Gérard Deledalle may doubtlessly be counted among those scholars who have contributed today towards the rediscovery of Peirce's work not only in the United States but in Europe as well, though it should be underlined that he does not merely limit himself to spreading Peirce's philosophy. Deledalle's works offer a specific and personal reading of Peirce, highlighting the contributions that may come from the latter in the current phase of the philosophical-epistemological and linguistico-semiotic debate at the centre of international scholarship.

To such scholars as Max Fisch and Thomas Sebeok certainly goes the merit of having greatly enhanced Peirce studies and not only in America, Peirce's homeland. However, the affirmation of the Peircean conception of sign both in semiotics as well as in the philosophy of language is to be attributed to another factor also. What we are referring to is the rather particular situation in which the science of signs finds itself today. In fact, we are witnesses to the current crisis involving the Saussurean model of sign which has played a determining role in the science for which it was conceived, that is to say, linguistics (as well as in the science that Saussure had foreseen, semiology), but which has also been of fundamental importance in the other human sciences, owing to the diffusion of structuralism.

Founded as it was upon the notions of *langue* and *parole*, the Saussurean model of sign lent itself to the identification of a direct link with the mathematical theory of communication and therefore, it made use of the similar terms *code* and *message*, *transmitter* and *receiver*. Consequently, we

may designate the semiotics of Saussurean derivation as semiotics of the code and message (see Bonfantini 1984; Rossi-Landi 1985). In semiotics of the code the sign is divided into two parts: the signifier and the signified. which refer respectively to the sign vehicle and its content. These parts are conceived as being in a relation of equality or of *equal exchange*, they are considered to be the expression of a perfect correspondence between communicative intentionality on the one hand, and interpretation on the other. As was brought to attention as early as 1961 (see Rossi-Landi 1961), this model views communication in terms of the passage of a postal package from one post office to another: all that the receiver must do is register the content of the message. In reality, he is only required to decodify the message without interpreting it. It is well worth remembering, as has been amply demonstrated (Ponzio 1986c), that the Saussurean model of sign bears traces of the theory of value as conceived by marginalistic economy of the School of Lausanne (Walras, Pareto). The assimilation of the study of language to the study of the marketplace, as it appears in a state of ideal equilibrium, gives rise to a static conception of sign. In fact, the sign is studied within the perspective of the synchronic axis of language and according to the paradigms of the logic of perfect correspondence between that which is given and that which is received, that is, according to the paradigms of the logic of equal exchange regulating all social relations in our current economic system (Rossi-Landi 1968, 1974).

Code semiotics does not provide adequate instruments for the description of the heteroglossia, plurivocality, ambiguity, and semantic wealth of signs. Owing to its complexity, verbal language in particular cannot be contained within the two poles of *langue* and *parole* (on this point see Bakhtin's critique of Saussure which goes back as far as 1928). Furthermore, the sign in general, in virtue of its sign quality, cannot be reduced to the level of mere signality (e.g. road signs). Indeed, that which characterizes signs in a strong sense with respect to pure and simple signals is the fact that, in the former, a single meaning does not exhaust the interpretative possibilities of the signifier. In other words, between the signifier and the signified we do not have a one to one relation. In contrast with signals, therefore, in the case of signs at high levels of sign resonance we do not interpret according to a code which has been completely and definitively established before and externally to the interpretative process - which would give rise to no more than a process of decodification. This means that interpretation (as against mere decodification) is never final nor guaranteed by appeal to a code with the function of prescribing the way in which signifiers and signifieds are to be exchanged (see Ponzio, Bonfantini, Mininni 1985a).

In this situation of *impasse* characterizing code semiotics, Peirce's semiotics has been viewed as a means of escape. It has been generally designated as the *semiotics of interpretation*. The *Collected Papers* by Charles Sanders Peirce only began appearing in 1931, while Peirce, in fact, had actually begun thinking and writing about signs as early as the beginning of the 1860s. His famous paper "On a New List of Categories" appeared in 1867. In it he presented those categories which he believed were most capable of accounting for the sign's complexity. And a yet more clearly articulated version of this description is generally considered to be his letter of 1904 to his correspondent Victoria Lady Welby (1837-1912; see Hardwick 1977).

Peirce's semiotics insists on the concept of interpretation. It identifies the sign's meaning (which Saussurean semiology leaves unexplained) in the interpretant, that is to say, in another sign which may take the place of the preceding sign.\* The interpretant, insofar as it is a sign, only subsists in virtue of another interpretant and so forth in an open-ended chain of interpretants. Such a procedure makes of semiosis an open process dependent upon the potential creativity of the interpretant. In this case, semiosis is not guaranteed by appeal to a code given that the code, including the choice of an adequate code, do not subsist outside the interpretative process (see Eco 1984).

According to Peirce a sign stands to someone for something in some respect or capacity (CP 2.228). The sign stands to someone in the sense that it creates an interpretant sign in the mind of the interpreter. Moreover, it stands for something under some respect or quality in the sense that it does not refer to the object in its wholeness (*Dynamical Object*), but rather only to some particular aspect of it (*Immediate Object*).

This second aspect of the sign leads to another consequence: that in addition to the concept of interpretation and of unlimited semiosis, another concept characterizing Peirce's semiotics is that of mediation. In fact, the sign is mediated by the interpretant without which it cannot express its meaning and, on the other hand, it mediates the relation to the object in any interpretative act whatever, from the lowest levels of perception to the highest levels of knowledge. Peirce's semiotics is in fact also a theory of knowledge, a cognitive semiotics and consequently it unites logic and semiotics. No kind of knowledge is possible without signs.

<sup>\*</sup>For a comparison between Saussure's semiology and Peirce's sem(e)iotics, see Deledalle (1979)

The dichotomy between signifier and signified is replaced with a trichotomous relation between object, sign and interpretant; and signs are characterized according to the dominant relation regulating the connection between these three elements. Insofar as it is turned towards the object the content of the sign determines that which Peirce calls the ground; insofar as it is turned towards the interpretant it forms the meaning. The relation between sign and ground is the object of study of Pure Grammar. The latter describes the formal conditions of the expressive function, in other words, it describes that which must be verified in the sign vehicle for it to bear meaning. The relation of the sign to the ground characterizes the sign according to the Peircean category of *firstness*. The relation between the sign and its object characterizes the sign according to the category of secondness. It is the object of study of Logic in the strict sense. The latter studies the formal conditions of the denotative function, that is, it ascertains that which must be true of the sign so that it may refer to the object. The relation between the sign and the interpretant concerns the sign as thirdness; it is the object of study of Speculative Rhetoric. This studies the formal conditions of the interpretative and explicative function of signs; that is, speculative rhetoric ascertains that which must be true of the sign so that it may determine an interpretant-sign in the mind of the interpreter.

Another important trichotomy may be added to the one we have just mentioned: the sign, in fact, flourishes in the dialectics between symbolicity, indexicality and iconicity. The first consists in the conventional character present in all signs though it is more accentuated in certain signs with respect to others, for example, in verbal signs. Iconicity concerns the relation of similarity between the sign and its object (which takes on different forms, such as images, metaphors and graphs). Indexicality (accentuated in traces, symptoms, and clues) is given by the relation of cause and effect and of contiguity between the sign and its object. Signs are generally dependent upon their relation to interpretants. Such dependency is of particular importance in the symbol owing to the dominance of conventionality. By contrast, the relation between signs and their interpretants carries less weight in the index and icon which, for this reason (as regards the sign in its triadic wholeness), may be considered, in Peirce's terminology, as degenerate signs (a word taken from the language of mathematics) as against genuine signs, that is, the symbol.

Interpretation differs from decodification in that the former implies an inferential process. Inference is established in the passage from the sign to its interpretant which are connected by a *dialogical* relation (see Ponzio

xiv

1985c; 1987). Inference, or as Peirce says, the argument, may be subdivided into three types. And these three types are yet again related to the classification of signs according to whether they are indices, icons or symbols.

The three types of argument are *deduction*, *induction*, and *abduction*. The order in which they are here proposed has them proceed from the lowest to the highest levels of dialogism and, therefore, of otherness in the relation between the premisses and the conclusion. The premisses and the conclusion may be conceived as the rejoinders exchanged by speakers in a dialogue. In deduction the relation between the premisses and the conclusion is regulated by necessity, more precisely by a relation of necessary contiguity as in the case of the index: the facts asserted in the premisses oblige us to accept the conclusion. This obligatory relation is also the expression of a low level of dialogism and of otherness. In the case of induction, the relation between the premisses and the conclusion is, instead, regulated by the inclination to accept the conclusion once the premisses have been accepted. Therefore, given that there is a margin of *free consensus*, the relation between the premisses and the conclusion is conventional so that induction corresponds to the symbol. The conclusion is differentiated with respect to the premisses given that it neither depends upon nor derives directly from them. Thus induction provides us with a cognitive increase which, however, is of a quantitative order. By contrast, in abduction or, as Peirce also says, in retroduction neither the obligation of contiguity nor the arbitrariness of conventionality play a determining role in the relation between the premisses and the conclusion. The conclusion is merely suggested by the premisses through a relation of relative similarity: we begin with a result which makes us think of or reminds us of a certain law on the basis of which the specific case in question may be explained. In this kind of inference the relation between the premisses and the conclusion is only probable so that it is dominated by conjecture, characterized by different degrees of risk and by the inclination to guessing. Furthermore, in abduction the law is searched for a posteriori with respect to observation and interpretation and is dependent upon them. Such dependence, which renders the law confutable, implies that in a given context one law may be referred to instead of another. In certain cases the law is found inside the already existent encyclopaedia of knowledge, in others it must be invented. In this way we pass from the lowest to the highest levels of innovation. In any case, in abduction the terms of the argument are related dialogically, in other words, they are connected by relations which are characterized by high levels of otherness. In the light of what we have said, it is obvious that in virtue of the role

carried out by similarity, abduction corresponds to the icon.

For Peirce semiotics and logic are strongly interconnected. This is due to the role he attributes to his model of sign in the act of interpretation. On the other hand, in the kind of semiotical approach that reduces the work of the interpreter to mere decodification and, therefore, all signs to the status of signals, no link is possible between the two fields of semiotics and logic. In Peirce's semiotics of interpretation yet another correspondence may be added to that between logic and semiotics: that between these two terms and his general philosophy or vision of the world.

In fact, Peirce attempts to integrate a conception of the world founded upon the category of necessity (*anancism*), with another founded upon the category of chance (*tychism*) and with yet another worldview founded upon the relation of mutual attraction and affinity (*agapism*). Now, to anancism correspond the index and deduction: to tychism the symbol and induction; to agapism the icon and abduction (see Peirce 1956).

The vastness of Peirce's fields of interest does not exclude coherence and unity of perspective. At the same time, however, we do not find in his work that rigidity and closure typical of those philosophies that aim at forming a system. In the book we are now presenting, Gérard Deledalle highlights the different aspects of Peirce's research and while underlining the plurality of interests, he also succeeds in evidencing the fundamental unity binding them. Furthermore, Deledalle's approach also has the merit of bringing to attention how distant Peirce was from the pretension to exhaustiveness.

At this point an aspect of Peirce's philosophy that Deledalle does not fail to point out is well worth remembering, that is to say, the attention focussed upon that kind of problem generally considered as belonging to the field of ethics.

Another characteristic feature of code semiotics is that it does not involve itself in questions of an evaluational type: of neither the ethical nor of the aesthetic order. This is due both to an exaggerated tendency towards specialism on the one hand, as well as to the limitative orientation towards pure descriptivism on the other. Code semiotics has never dealt with problems concerning value if not in the sense of the value of signs within sign systems, in other words, it has never dealt with evaluation and judgements.

The situation is completely different when we look at Peirce and at those who have developed his theories. Charles Morris, for example, dedicated a large part of his research to the problem of ethical and aesthetic

xvi

value judgements: after having written Foundations of the Theory of Signs (1938), and Signs, Language, and Behavior (1946), where these topics are already proposed within a semiotical framework, he specifically focussed upon a theory of value in his Varieties of Human Value (1956), and in the important book which unites the two lines of development characterizing his research on signs and on values (as Morris himself states in the relative introduction), Signification and Significance: A Study of the Relation of Signs and Values (1964).

Peirce's cognitive semiotics is not such in the sense that it concentrates uniquely upon problems concerning knowledge, that is, upon those issues which are at the heart of epistemology and gnoseology. Inseparable as it is (coherently with Peirce's pragmatism) from man's behaviour and the totality of his interests, the notion of knowledge necessarily involves orientations and issues of an evaluational order.

With specific reference to this non sectorial conception of signs as inaugurated by Peirce, and by contrast with semiotics viewed solely as a theory of knowledge, the proposal has been made that we use the term Ethosemiotics (Ponzio 1989). In this perspective, to recall Peirce also means to recall authors that have opened the way to this broader view of the relation between signification and significance where, exactly in the sense intended by Morris, this second term, significance, is intended to designate the disposition towards evaluation, the value that we confer upon something, the fact that something is significant. Here significance is not intended in the sense that something has meaning, but rather in the sense that this something is of a certain importance to us because it involves us in some way both affectively and pragmatically. Among these authors — we have already recalled Morris - special mention should be made of Victoria Lady Welby who, among other things, was in close epistolary contact with Peirce with whom she discussed scientific questions concerning signs. Welby herself oriented a large part of her research in the direction of the question of significance as value and even coined a special term to refer to the discipline that was to concern itself with such issues: the term is Significs (see Welby 1903, 1983<sup>2</sup>; 1911, 1985<sup>2</sup>). This discipline thus takes its distances and distinguishes itself from both semantics as well as from semiotics intended in a restricted sense.

Welby, whose book Peirce reviewed for the Nation in 1903 underlining its importance, distinguished between three levels of meaning which she labelled *sense*, *meaning* and *significance*. The level of sense is the level of

immediate response to and use of the sign, meaning concerns the intentional and volitional aspects of signification, finally significance deals with the value which the sign has for each of us. Concerning this last aspect, we may add that Welby uses the term significance more or less in the same sense as Morris.

Furthermore, in a letter to Welby (for the correspondence between Peirce and Welby see the volume edited by Hardwick, Semiotic and Significs 1977), Peirce himself establishes a relation of correspondence between Welby's three levels of meaning and his own triadic division of the sign. He states that his immediate interpretant, dynamical interpretant, and final interpretant correspond respectively to Welby's sense, meaning and significance. Peirce's immediate interpretant regards the meaning ordinarily and habitually used by the interpreter and, therefore, as Welby says concerning sense, it regards the interpreter's immediate response to the sign. The dynamical interpretant, instead, concerns the sign's signification in a specific context and, therefore, as Welby claims for meaning, it is used according to a specific intentionality. Furthermore, that Peirce should have coupled his final interpretant with Welby's significance is of particular interest in the context of our current discussion. In fact, Peirce's final interpretant concerns the sign as it appears at the extreme limits of its interpretative possibilities, that is, it concerns all those possible answers that the sign may provoke in the unlimited chain of interpretants. In other words, the final interpretant designates the creative potentialities of the sign.

Now, it is precisely this correspondence with Welby's significance that attests how for Peirce signifying potentialities concern fundamentally evaluational attitudes: thus even Peirce's semiotics, all things considered, is oriented towards significs as intended by Welby or towards what has been suggested we might call ethosemiotics. Both Peirce's semiotics as well as Welby's significs are open to the ethical-pragmatic dimension of signs, to their ethical-operative dimension. In a letter to Peirce, Welby says that her significs is a "pratical extension" of semiotics (see Hardwick 1977). In our opinion, however, and Deledalle would I think agree, such a specification may be considered to be superfluous with respect to Peirce's semiotics for the latter indeed keeps account of the ethical-evaluational aspects of signification (Deledalle 1989).

Yet once again, with reference to this aspect also, Peirce's work offers us suggestions for the surpassing of a limit traceable in current research in the science of signs: that of having concentrated far too exclusively upon

xviii

problems regarding the theory of knowledge and communication, and consequently of having lost sight of the problem of man considered in the wholeness of his relations to himself, to the world and to others.

As I have attempted to demonstrate, a revisitation of Peirce's theories is of particular significance for us today. And, indeed, Deledalle offers us a global reconaissance of Peircean philosophy, in spite of the limited number of pages forming this book. Deledalle's remarkable capacity for synthesis is all to the advantage of that reader who wishes to enter into contact with the work of such a great and multifaceted philosopher and semiotician.

This synthetic landscape is the result of two dominant motifs running through Deledalle's work:

a. he aims at demonstrating a very precisely delineated thesis: that Peirce's research is characterized by the category of continuity despite innovations and the broadening of his fields of interest. In other words, *synechism* (evolution in continuity) a category theorized by Peirce as part of his vision of the world or "metaphysics" is traceable throughout the whole of his works;

b. he proposes a chronological reconstruction of Peirce's philosophy which favours our view of its development as a continuous sequence by contrast with the plurality of itineraries that a thematic approach would have presented. And on the other hand, a chronological analysis, especially if meticulously conducted on the basis of continual references to Peirce's texts as is the case with the book under discussion, also enriches the thematic approach with valuable elements for verification and ascertainment.

Deledalle subdivides the whole of Peirce's research into three phases calling them: the *New England period* (1851-1870), the *Cosmopolitan period* (1870-1887), and the *Arisbe period* (1887-1914); Arisbe is the name that Peirce gave to his home in Milford and was connected to the memory of his journey to Greece (it is in fact the name of a city in the island of Lesbos).

Deledalle's thesis is that the unfolding of Peirce's research may be subdivided into these three phases with reference to the three steps described by Plato in his Myth of the Cave. Movement one: the intention of leaving the cave; in this phase the author takes up "nominalist" and empiricistmaterialist stances. Movement two: contemplation of that which is a reflection of the sun; this is the mathematical and methodological phase. Movement three: leaving the cave and looking at the sun; this is the phase of scientific metaphysics. (Deledalle does not fail to link these theoretical

periods to Peirce's private life, including his sentimental life, for example, he connects the period in which Peirce concentrated on Greek cosmology and attempted to contemplate the sun, to his relation with the young French woman Juliette Annette Pourtalais whom he met in 1878 and married — after his separation from Melusina Fay — in 1883.)

The chapter titles in Deledalle's book also suggestively recall Plato's myth of the cave. They are three and correspond to the three above-mentioned phases: "Leaving the Cave"; the "Eclipse of the Sun" (here, too, there is a connection with Peirce's biography given that, as an assistant at the Harvard Observatory, he was sent to Europe by the U.S. Geodetic Survey to study the eclipses of the sun on the 22<sup>nd</sup> of December 1870); and "The Sun Set Free".

The last phase is particularly interesting especially if considered with a view to what we have said so far by way of introduction to some of the themes which occupied Peirce's attention. In two articles "On the Algebra of Mathematics" 1885, and "A Guess at the Riddle" 1890, Peirce proposed a new theory of categories. He identified three and described them as phaneroscopic or phenomenological categories: firstness designates being in itself and does not refer to anything outside itself; secondness is the being of that which exists in virtue of something else and in relation to which it is a second; thirdness refers to something which is what it is in virtue of the things between which it mediates. These categories have the function of explaining phenomena: "phenomenon" does not only designate sensorial impressions but also includes all that which appears to consciousness. This is why Peirce prefers to speak of "phaneron" and therefore of "phaneroscopy" rather than of phenomenon and therefore of phenomenology.

Moreover, in the last phase, in addition to phenomenology which is a theory of categories (it should be remember that the title given by Deledalle to the original French edition of this current English translation is *Charles S. Peirce: phénoménologue et sémioticien*), Peirce turns his attention to the normative sciences (aesthetics, ethics and logic) and to metaphysics (ontology, religious metaphysics and cosmology). The three above-mentioned categories are present in this tripartition of thematic interests and disciplines: in fact, phenomenology analyses phenomena in themselves and therefore as they are in their firstness; the normative sciences examine phenomena in their relation to ends and purposes and therefore in their secondness; metaphysics considers phenomena in the totality of their relations, that is, in their thirdness.

#### ON THE SEMIOTICS OF INTERPRETATION

Peirce takes an explicit interest in the theory of morals relatively late in his studies, and as Deledalle explains, he does so thanks to his readings of Aristotle's *Nicomachean Ethics* and *Politics*. Peirce believes that the object of ethics is the problem of ultimate ends. These are neither individual pleasure (hedonism), nor the good of society (British Utilitarianism), but rather they are to be searched for in that very Reason which regulates the evolutionary development of the universe. Such evolution, characterized as it is by continuity (synechism), is never complete and finished; and thus the Reason governing this process, that is, the ultimate end or the *summum bonum*, can never be completely or definitively achieved.

Deledalle insists on the scientific character of Peirce's metaphysics which he largely attributes to the fact that it is devoid of all forms of dogmatism thus presenting itself as an open system coherently connected to all the conceptual arguments and instruments of his work. Concerning this last point, of great interest is the originality of Peirce's approach to the problem of God. In 1908 he wrote an article entitled "A Neglected Argument for the Reality of God" in which he maintained that the existence of God cannot be proven on the basis of either the categories of thirdness or secondness, but rather it is firstness that comes into play. God is musement, pure play without rules or laws: He coincides with creativity, with the evolution of the universe, with continuity and with the principle of synechism. It becomes obvious therefore, as Deledalle demonstrates, how this principle of synechism runs throughout the whole of Peirce's research. And it is not incidental that Peirce should have devoted his last paper — "Achilles and the Tortoise" — to the issue of continuity.

We have referred to the relation between Peirce and Welby. It should be remembered that another common element uniting the research of these two scholars is the fact that they both insert ethical and religious themes, with coherence and scientific rationality, within the global context of their research.

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### Foreword

Max H. Fisch

Professor Deledalle has long been and still is the leading French historian, interpreter and critic of American philosophy as a whole, of pragmatism in particular, and, above all, of Peirce.

If we think of pragmatism as the chief American contribution to philosophy, and of Peirce, James and Dewey as the leading American pragmatists, it becomes a matter of interest that collective editions of all three are in progress; that those of Dewey and Peirce are chronological; and that those of James and Dewey are nearing completion, while that of Peirce, though long in preparation, may take another decade.

Of the twenty-volume Peirce edition, volumes 1 (1857-1866), 2 (1867-1871) and 3 (1872-1878) have already appeared, and volume 4 (1879-1884) will soon follow. Volume 2 contains Peirce's most explicitly anti-Cartesian publication, his three articles of 1868-69 in the *Journal of Speculative Philosophy*, the second of which begins: "Descartes is the father of modern philosophy..." and proceeds to summarize the anti-Cartesian positions taken in the first article and elaborated in the second and third.

The third volume contains the six articles in the *Popular Science Monthly* in 1877-78, usually called his pragmatism series (though that name does not appear in them), and the French forms of the first two which appeared in the *Revue Philosophique* in 1878-79. Professor Deledalle is a contributing editor for this volume, and is our chief authority on the relations between the French and the English forms of those two articles.

On astronomical or geodetic business for the U.S. Coast Survey (whose name was changed by act of Congress in 1878 to Coast and Geodetic Survey), Peirce was in Europe five times — in 1870-71, 1875-76, 1877, 1880, and 1883 — for periods adding up to nearly three years. He spent more time in France than in any other country, and more time in Paris than

in any other city. (The Franco-Prussian War kept him from Paris in 1870-71, but he crossed southern France by two different routes on the way from Italy to Spain and back.) He became a familiar figure at the Paris Observatory, at the Bibliothèque National, and at the Bureau International des Poids et Mesures at the Pavillon de Breteuil in Sèvres. He addressed committee meetings of the International Geodetic Association, and in June 1880 he addressed the Académie des Sciences "Sur la valeur de la pesanteur à Paris." Though his French was far from perfect, it was the foreign language that he knew best. French literature as well as science, mathematics, and philosophy was well represented in his private library.

In Paris in 1877 he arranged for the entire pragmatism series to appear in French in the *Revue philosophique* and later in book form; but even in English the series was never completed, and in French it did not get beyond the "deuxième partie."

Ten years into his Arisbe period, Peirce and his wife Juliette contemplated moving to France, in or near Paris, with a view to his writing weekly columns for English and American newspapers on current developments in science on the continent, in the course of which he hoped to visit every leading laboratory.

Toward the end of his life he and Juliette contemplated retiring to a town between Paris and Nancy.

But neither of these hopes was fulfilled. It has remained for Professor Deledalle to make Peirce at home in France.

XXX

# Presentation

The first introduction to a systematic reading of Peirce, this work is the intellectual biography of the greatest of American philosophers. Peirce was not only a pioneer in logic and the creator of a philosophical movement called Pragmatism, he also proposed a phenomenological theory, quite different from that of Husserl, though equal in profundity, long before Saussure, and in a totally different spirit: a semiotic theory whose present interest owes nothing to passing fashion and everything to its fecundity.

Throughout his life Peirce wrote continually about sign and phenomenon (or phaneron). Consequently his writings must be studied chronologically if they are not to appear incomprehensible or contradictory. Not the least of the merits of this book is to clarify Peirce's thought by analysing its development chronologically.<sup>1</sup>

We follow the evolution of Peirce's thought from his critique of Kantian logic and Cartesianism (Chap. I, "Leaving the Cave:" 1851-1870) to his discovery of modern logic and pragmatism (Chap. II, "The Eclipse of the Sun:" 1870-1887) and finally to a "semiotic" founded on a phenomenology the base of which is the logic of relations and the crowning-point scientific metaphysics (Chap. III, "The Sun Set Free:" 1887-1914).

The book includes a detailed chronology and a general bibliography.

### Introduction

"His [Peirce's] interests were not restricted to logic, pragmatism, metaphysics, mathematics, geodesy, religion, astronomy, and chemistry. He also wrote on psychology, early English and classical Greek pronunciation, psychical research, criminology, the history of science, ancient history, Egyptology, and Napoleon, prepared a thesaurus and an editor's manual, and did translations from Latin and German [and French]. James called Peirce the most original thinker of their generation; Peirce placed himself somewhere near the rank of Leibniz. This much is now certain, he is the most original and versatile of America's philosophers and America's greatest logician."

Paul Weiss, Biography of Charles S. Peirce, in Richard J. Bernstein, ed., *Perspectives on Peirce*, Yale University Press, 1965, p.12.

Charles Sanders Peirce,<sup>2</sup> son of the mathematician Benjamin Peirce, was born in Cambridge, Massachusetts, on the 10th of September 1839. He was educated by his father who introduced him at an early age to mathematics, the philosophy of Kant, logic, chemistry and to that art of mental analysis in which Charles Peirce was to excel.

Peirce did not distinguish himself particularly at Harvard where a B.A. was conferred upon him in 1859. After some initial hesitation in his choice of a career he eventually decided to enter the United States Coast Survey in 1861. He obtained his M.A. at Harvard in 1862, and subsequently a B.Sc. in chemistry *summa cum laude* in 1863.

Peirce was to leave the Coast Survey only in 1891 when he retired to Milford, Pennsylvania. He held courses in logic at the Johns Hopkins University for a few years, and gave lectures here and there, but despite the efforts of William James, he never obtained a permanent position at a university. He died in Milford on the 19th of April, 1914.

Peirce published only one book during his lifetime: A work on astronomy, and nothing more than articles on philosophy, logic and mathematics. His publication projects were numerous though he only managed to carry through one of them, for which, however, he was not able to find a publisher. It was only a collection of articles which he had already published and which he had revised and corrected for this new edition: *Search for a Method*, 1893. His most important works have been brought together in his *Collected Papers*<sup>3</sup> of which six volumes appeared between 1931 and 1935, and another two in 1958.

Peirce, all the same, exercised a great influence in logic and philosophy during his lifetime: In logic on Schroeder and Royce and through the latter on C.I. Lewis; in philosophy, on William James who brought Peirce's pragmatism into fashion and on Dewey who was later to develop his theory of research. But it was only after his death that the wealth and originality of his thoughts on phenomenology and semiotics were to be discovered. Though his phenomenology owes everything to Kant and to his own triadic logic and nothing to Husserl whose psychologism he criticized, it answers the same question posed by the latter while at the same time opening up new horizons, just as his semiotics does, founded as it is upon a triadic categorial phenomenology, different from the direction that Saussure's psychosociological semiotics was to take.<sup>4</sup>

From a historical point of view, the logician, philosopher, phenomenologist and semiotician are but the varied expressions of Peirce's mathematical formation; one might perhaps say he was above all a chemist, indeed an alchemist of thought. We can distinguish a posteriori three phases in the development of Peirce's philosophy.<sup>5</sup> The New England period from 1851 to 1870, the cosmopolitan period from 1870 to 1887 and the Arisbe period, from the name which he gave to his house in Milford where he lived during the last twenty-six years of his life, from 1887 to 1914. These three phases correspond to the three stages in the development of Peirce's thought: Phases which can justly be likened to the steps described by Plato in his Myth of the Cave. The first stage, for Peirce, was a period in which he had to leave the Cave. He was, at that time, a "nominalist" for

#### INTRODUCTION

whom facts only existed, with all that this implied: "sensationalism, phenomenalism, individualism and materialism" (8.38). The second stage had him coming to grips with the reflections of the sun, this is the logico-mathematical and methodological period. He became aware of the reality of "universals" or, as he says, of "generals," but not yet of the reality of "possibles." The third stage is that of the contemplation of the sun. It is during this period that Peirce elaborated his scientific metaphysics on the basis of a realist theory of categories.

It must be observed that Peirce put the problem of metaphysics back into the context of the debate on universals. This was not due to a particular liking for medieval philosophy, but to logical necessity. It is important to make clear, however, that "generals" are not the same as "universals." The latter belong to pure logic, the former to, let us say, "experimental" logic. The extent to which Peirce kept faith to the philosophy of Duns Scotus is also disputed among historians of philosophy. The only preference cultivated by Peirce to the highest degree was that of logically founded systems. It was at his distinct request that his father (if we can take Peirce's word for it), defined mathematics for the first time as "the science which draws necessary conclusions."<sup>6</sup> The preference explains the attraction that Kant's system exerted upon the young Peirce as well as the fact that he did not make it his own, for the logical bases of Kant's system were inadequate.

Schematically, Peirce's thoughts underwent a series of transformations which were required to maintain the equilibrium of a system formed by a logical basis, phenomenological or ontological structure and cosmological content. It goes without saying that the pressures which act upon the system and threaten its coherence are both internal and external. Internal owing to its logic, external owing to its cosmology which could not fail to take the contributions of science into account. It was initially the logic of Kant's system which failed to satisfy Peirce, and this encouraged him to read Aristotle and the logicians of the Middle Ages: Saint Anselm, Abélard, Peter of Spain, John of Salisbury and above all Duns Scotus and Ockham. This he did between 1862 and 1865 and as a result, in 1867, he proposed a new list of categories. But it was the whole predicative and dualist conception of logic which was soon to appear defective to him. Then, in the 1870's, influenced by his reading of De Morgan, Peirce introduced the triadic logic of relations. But paradoxically, his new list of categories, though trichotomous, no longer seemed to satisfy him. And, apart from an almost accidental "pragmatic" interpretation of this list in 1875, he only returned to it in the

final phase of his work. The fact is that the categories are linked to both his logic and his cosmology. Now, science offers an image of the universe which demands that we rethink traditional cosmology, and it follows methods which are incompatible with those that produced this cosmology. Indeed, Darwin replaced a stable world in which everything is determined with a world in transformation in which chance predominates. The logic of complete induction is replaced by the calculation of probabilities, the logic of the discovery of what is there, but simply hidden, is replaced by the logic of invention, the creation of the new. The logic of science can no longer be purely and simply the logic of complete induction: rather a logic of induction or hypothesis, which Peirce was to call abduction, plays a determining role. "Chance" is no longer that which jeopardises the order of the universe, but rather it is a constitutive element of the universe, and it is "continuity" that must find justification.
## Chapter one

# Leaving the Cave (1851-1870)

#### 1. From nominalism to the critique of Kantian logic

Charles S. Peirce's formation underwent a double influence, that of New England which tended towards the conservative and empiricist mother country, and that of his father. The latter was a mathematician and philosopher, reader of Swedenborg and great admirer of Kant, a very liberal man who counted Agassiz, Emerson, Oliver Wendell Holmes, Longfellow among his friends, to mention but the most well-known of those whom Benjamin Peirce received and whom the young Charles could frequent and listen to.

Charles Peirce took an interest in chemistry and mathematics at a very early age. He read Whately's *Logic* when he was twelve and at the age of sixteen he had already begun to make a thorough study of *Critique of Pure Reason*, under the guidance of his father. At university he was to devote himself in particular to studies in science and philosophy, his curriculum included Reid, Jouffroy, Mill's *Logic* and Thomson's *The Law of Thought*. But he also read Locke, Hume and Hobbes.

Empiricism could have kept him chained forever in the depths of the cave had he not read Kant. Whately and Hobbes had made a nominalist of him. He agreed with the sensualist theses of the empiricist theory of knowledge up to their phenomenalist implications. If Reid and Scottish philosophy and his "inclination" possibly (8.38) seem to have preserved him morally from individualism and materialism, he was none the less at that time "a young determinist — Peirce says *necessitarian* — of the most odious type."<sup>7</sup> Kant who, in Peirce's eyes, has the great merit of having always remained a physicist who devoted himself to philosophy (1.7) was to help him break his chains.

The most important writings of this period include two series of articles, one on logic published in 1867 in the *Proceedings of the American Academy of Arts and Sciences*, and the other on intuitive knowledge which appeared in 1868 in the *Journal of Speculative Philosophy*, to which must be added a review of Berkeley's works in the *North American Review*, October 1871, which marks the transition from the first period to the second.

In the first series, Peirce criticized Kant's logic and proposed a new list of categories; in the second he attacked the spirit of Cartesianism, confuted its theory of knowledge and replaced it with a theory of signs which brought with it a new conception of the nature of the real, borrowed from Duns Scotus.

What Peirce criticizes in Kant's logic is the latter's interpretation of Aristotle's logic and not Aristotle's logic itself. Peirce had read Boole and in the same series attempts to improve the latter's logical calculus, but here. as in his criticism of Kant, within the framework of the analysis of the proposition into subject, copula and predicate. What Peirce questions is Kant's reduction of the figures of the syllogism to the first figure in Barbara. Thus in order to classify what he already calls arguments. Peirce is led to distinguish between the argument and the "leading principle of the argument." The argument is the "body of premisses" (that which is explicitly laid down) and the leading principle of the argument is the principle implied in the judgement, itself implicit, so that if the premisses are true then the conclusion is true (2.462). Therefore "the leading principle contains, by definition, whatever is considered requisite besides the premisses to determine the necessary or probable truth of the conclusion" (2.465). Whatever is not in the premisses must be in the principle and what is eliminated on the one hand must be added on the other. But there is a limit to this elimination: The premisses cannot be completely suppressed and there is a portion of the leading principle which cannot be eliminated; the "logical principle" of the argument (2.466). Kant's error was that of believing that the second, third and fourth figure did not possess a logical principle which was not implied in the first figure. "A chemist might as well argue - as Peirce was to say later in 1898 — that because water boiled with zinc dust evolves hydrogen, and the hydrogen does not come from the zinc, therefore water is a mere form of hydrogen." And Peirce continues: "In short, Kant omits to inquire whether the very reasoning by which he reduces the indirect moods to Barbara may not itself introduce an additional logical principle" (4.2).

And Peirce demonstrates that this is what happens in reality: the second and third figures each involve an additional logical principle which cannot be eliminated from the leading principle of the inference and both of these principles enter into the fourth figure.

#### 2. A new list of categories

"On a New List of Categories", a paper about which Peirce was still saying in 1895 that it was the "least unsatisfactory, from a logical point of view" that he had ever produced (2.340), sets forth the results of the most thorough analysis of the nature of arguments that Peirce had just completed. But, as we will see, it was not to be so much a question of substituting a new list of categories for the existing lists (for Peirce's analysis does not draw on Kant alone, but equally on Aristotle and Hegel) as of introducing between the extreme categories of substance and being the categories necessary to be able to pass from one to the other. Initially Peirce deals with the same problem as Kant, the same one set to him by "nominalism": How are we to reduce the manifold impressions of the senses to unity? But Peirce's reply was inspired more by Duns Scotus than by Kant whose idealism he was soon to oppose with his categorial realism.

To begin with, Peirce grants that the manifold impressions of the senses can only be reduced to unity through conceptions. The universal conception nearest to sense "is that of *the present, in general*" (1.547): "It" or "substance," "pure denotative power of the mind" without connotation and consequently without proper unity. "The unity to which the understanding reduces impressions is the unity of a proposition" which "consists in the connection of the predicate with the subject" and "that which is implied in the copula — or the conception of *being* — is that which completes the work of conceptions of reducing the manifold to unity" (1.548). Thus substance and being mark "the beginning and end of all conception. Substance is inapplicable to a predicate, and being is equally so to a subject" (*Ibid*.).

The union of substance and being is attained by precision or abstraction which must be distinguished from discrimination and dissociation. Discrimination is a "mental" distinction; dissociation is a "physical" separation; precision is situated between the two. The hierarchy of these modes of differentiation is the following, in ascending order.

Discrimination: We can distinguish red from blue, space from color, color from space, but *not* red from color.

Precision: We can prescind (or abstract) red from blue, space from color, but not color from space *nor* red from color.

Dissociation: We can dissociate red from blue, but *not* space from color, *nor* red from color.

It will be observed that precision is not a reciprocal process: It expresses, as we will see, the hierarchy of categories.

Peirce identifies three intermediate conceptions or categories between being and substance.

1. Quality (reference to a ground).

"The conception of *being* arises upon the formation of a proposition. A proposition always has, besides a term to express the substance, another to express the quality of that substance; and the function of the conception of being is to unite the quality to the substance. Quality, therefore, in its very widest sense, is the first conception in order in passing from being to substance" (1.551).

In the proposition "this stove is black," the quality is "blackness" which Peirce calls "ground."

"Reference to a ground cannot be prescinded from being, but being can be prescinded from it" (*Ibid.*).

Peirce specifies that in all this he has not resorted to introspection. We will soon see that introspection, and psychologism in all its forms, is his pet aversion because, all things considered, it comes into the sphere of nominalism. If we resort to introspection, says Peirce, the conception of quality appears as "given" in sense impressions. Now this is obviously not the case since a proposition tells of the applicability of a mediate conception to a more immediate conception, so well that the conception which is mediate is considered as independent from that to which it applies. The conception of quality only appears once "blackness" is prescinded from that which is immediately given: The black stove.

2. *Relation* (reference to a correlate).

We can know a quality only through its similarity or difference with respect to another. In this way a thing is referred to a correlate. "The occasion of the introduction of the conception of reference to a ground is the reference to a correlate, and this is, therefore, the next conception in order" (1.552).

"Reference to a correlate cannot be prescinded from reference to a ground; but reference to a ground may be prescinded from reference to a

correlate" (*Ibid.*). In other words, we cannot prescind 2 from 1, but we can prescind 1 from 2.

3. *Representation* (reference to an interpretant).

"[...] suppose we think of murderer as being in relation to a murdered person; in this case we conceive the act of the murder, and in this conception it is represented that corresponding to every murderer (as well as to every murder) there is a murdered person; and thus we resort again to a mediating representation which represents the relate as standing for a correlate with which the mediating representation is itself in relation" (1.553).

"Again, suppose we look up the word *homme* in a French dictionary; we shall find opposite to it the word *man*, which, so placed, represents *homme* as representing the same two-legged creature which *man* itself represents" (*Ibid.*).

"[...] every comparison requires, besides the related thing, the ground, and the correlate, also a *mediating representation which represents the relate* to be a representation of the same correlate which this mediating representation itself represents. Such a mediating representation may be termed an interpretant, because it fulfils the office of an interpreter, who says that a foreigner says the same thing which he himself says" (*Ibid.*)

"Every reference to a correlate, then, conjoins to the substance the conception of a reference to an interpretant; and this is, therefore, the next conception in order in passing from being to substance" (*Ibid.*).

"Reference to an interpretant cannot be prescinded from reference to a correlate; but the latter can be prescinded from the former" (*Ibid.*). In other words, we cannot prescind 3 from 2, but we can prescind 2 from 3.

Of the conclusions of the 1867 article, we will consider the following points:

1. There are five conceptions which we may term *categories*, says Peirce:

"Being

Quality (reference to a ground)

Relation (reference to a correlate)

Representation (reference to an interpretant)

Substance" (1.555).

And we may term the three intermediate conceptions "accidents." These will become the three Peircean categories of firstness, secondness and thirdness.

2. The passage from the multiple to one is *numerical*. This is evidently

the reason for the names of the Peircean categories and for their reduction to three.

"The conception of a *third* is that of an object which is so related to two others, that one of these must be related to the other in the same way in which the third is related to that other. Now this coincides with the conception of an interpretant. An *other* is plainly equivalent to a *correlate*. The conception of second differs from that of other, in implying the possibility of a third. In the same way, the conception of *self* implies the possibility of an *other*. The *ground* is the self abstracted from concreteness which implies the possibility of another" (1.556).

3. Given that no one of the categories can be prescinded from those above it, the list of supposable objects is the following:

"What is.

Quale (that which refers to a ground)

Relate (that which refers to ground and correlate)

Representamen (that which refers to ground, correlate, and interpretant) $^{8}$ 

It" (1.557).

4. Signs are divided into *likenesses*, *indices* and *symbols* (1.558) which Peirce was to define differently once he mastered the logic of relatives (1.564). In fact, he does not use the word "icon" for "likeness" (as he does in 1.564, written in 1899), he terms the index "index or sign" and makes the symbol a "general sign."

"This third class really consists of plural relations, all of which may be regarded as compounds of triadic relations, that is, of relations between triads of objects. A very broad and important class of triadic characters consists of representations. A representation is that character of a thing by virtue of which, for the production of a certain mental effect, it may stand in place of another thing. The thing having this character I term a *representamen*, the mental effect, or thought, its *interpretant*, the thing for which it stands, its *object*" (1.564).

We may thus observe that as early as his first important article — and this is why it is important — Peirce proposes a logical theory of categories and signs. Indeed the logic of relations will later supplant Aristotelian predicative logic. This will lead to a modification of the content of the categories and to a redefinition of signs, though the structure of the system is established from the outset. The three categories first, second and third, the division of signs into sign first, object second and interpretant third,

#### LEAVING THE CAVE

with all that the hierarchy of categories implies for the sign: The quale first (likenesses or icons) refers only to the ground, the relate second (indices) to the ground and to the object or correlate, the representamen third (symbols) (which in the final system will serve to indicate the first sign, 2.274) refers to the ground, object and interpretant.

## 3. Against the spirit of Cartesianism: A new "realist" conception of the thought process

Still more surprising is perhaps the anti-psychologist attitude of Peirce which established itself in his 1868 articles. The whole of the psychology of the faculties is called into question here and, through it Cartesian thought with its phenomenalist and idealist, including Kantian, expressions. What is under attack in the 1868 articles is "the spirit of Cartesianism" (5.264) which is nothing but nominalism (5.310), all "all the salad of Cartesianism" (5.63) as Peirce was to say later.

In the first article of the series, "Questions Concerning Certain Faculties Claimed for Man," Peirce asks himself in a Kantian fashion and in scholastic form what the conditions are of the possibility of cognition. Peirce proposes seven questions, four of which relate to the faculties and three to the possibility of knowing otherwise than by means of the faculties of knowledge. These are the questions:

1. "Whether by the simple contemplation of a cognition, independently of any previous knowledge and without reasoning from signs, we are enabled rightly to judge whether that cognition has been determined by a previous cognition or whether it refers immediately to its object."

2. "Whether we have an intuitive self-consciousness."

3. "Whether we have an intuitive power of distinguishing between the subjective elements of different kinds of cognitions."

4. "Whether we have any power of introspection, or whether our whole knowledge of the internal world is derived from the observation of external facts."

5. "Whether we can think without signs."

6. "Whether a sign can have any meaning, if by its definition it is the sign of something absolutely incognizable."

7. "Whether there is any cognition not determined by a previous cognition."

The answer to each of these questions is negative.

By "intuition," Peirce means "a cognition not determined by a previous cognition of the same object, and therefore so determined by something out of all consciousness." And, he says, "a cognition not so determined, and therefore determined directly by the transcendental object, is to be termed an *intuition*" (5.213). Intuition may take on three forms according to the order of "precision" or abstraction applied to it.<sup>9</sup> Indeed, if we assume that the thought process requires the three intuitive faculties revealed by analysis, the ability to recognize intuitively cognitions resulting from intuition (1) may be "separated" from the other two faculties and examined separately. Now "there is no evidence that we have this faculty, except that we seem to *feel* that we have it" (5.214). Having established this we can "separate" the capacity of having self-consciousness (2) from the capacity of intuitively distinguishing the subjective elements of cognitions (3). And, since "self-consciousness may easily be the result of inference" (5.237), there is no need to presuppose the existence of an intuitive self-consciousness. Therefore we can "separate" the third faculty which will enable us to distinguish that which is subjective in the different cognitions from that which is not. But we do not question that there is a difference between that which is present to the mind and that which is not. And this difference is sufficient in itself without the need to resort to a special faculty to "distinguish the subjective elements of consciousness" (5.241). In order to know our internal world we must choose between the faculty of introspection and the observation of external facts.

This leads to the four principles of non-intuitive cognition set forth by Peirce at the beginning of his second article entitled "Some Consequences of Four Incapacities."

"1. We have no power of Introspection, but all knowledge of the internal world is derived by hypothetical reasoning from our knowledge of external facts.

"2. We have no power of Intuition, but every cognition is determined logically by previous cognitions.

"3. We have no power of thinking without signs.

"4. We have no conception of the absolutely incognizable" (5.264).

The first principle is obviously directed against Descartes and his method of the introspective analysis of ideas. Peirce takes the opposite view. While Descartes reaches knowledge of the external world by analysing the content of his thoughts, Peirce maintains that we can acquire knowl-

LEAVING THE CAVE

edge of the internal world only through analysis of external facts. Though Peirce uses the expression "hypothetical reasoning," what he advocates here is not a scientific analysis which can be subjected to a public test as he will do later, but rather the production of hypotheses concerning the nature of the internal and *external* world. We add "and external," because the hypothesis of the two worlds leads to the useless multiplication of thought processes. "In other words, we must, as far as we can do so without additional hypotheses, reduce all kinds of mental action to one general type" (5.266). This is the principle of Ockham's rasor or the principle of parsimony.

The second principle stated by Peirce concerns the different forms of "nominalism:" English empiricism and Kantian idealism. Empiricism is caught up in a dilemma: Either together with Locke we perceive reality outside our mind in sensorial impressions which are inside our mind, or we dispense with reality-partially with Berkeley (esse est percipi: There is a reality, but it is not external), or completely with Hume. In one case as in the other, we are dealing with nominalism, "for nominalism arises from taking that view of reality which regards whatever is in thought as caused by something in sense, and whatever is in sense as caused by something without the mind," and "everybody knows that this is the character of Locke's philosophy" (8.25). Berkeley is Locke's heir "his whole philosophy rests upon an extreme nominalism of a sensationalistic type" (8.26). Hume's philosophy does not differ from Berkeley's, except that contrary to Berkeley Hume has "treated mind and matter in the same way," something in fact which Berkeley should have done, for his criticism of the existence of matter equally applies to the existence of mind (8.34).

That at the same time Peirce attacks Kant's nominalism is obvious by definition, seeing that knowledge cannot but be determined by a previous cognition or by a transcendental object (5.213). Now Kantian intuition has as its object a transcendental object.

Therefore, isolated or immediate knowledge does not exist. Every cognition follows on from another. It is part of a process. This process whose logical form is the process of valid inference "which proceeds from its premiss, A, to its conclusion, B, only if, as a matter of fact, such a proposition as B is always or usually true when such a proposition as A is true" (5.267). Though it may seem doubtful that all knowledge proceeds through explicit syllogism, it is a matter of experience that if a man believes in certain premisses "in the sense that he will act from them and will say that they are

true," the conclusion, under favourable conditions, will activate the premisses, in other words, cause him to act and say that the conclusion is true. Something, therefore, must take place within the organism which is "equivalent to the syllogistic process" (5.268).

Under the influence of Duns Scotus Peirce did not take long to give a name to this organic equivalent of inference. It is habit. "There are two ways in which a thing may be in the mind — says Peirce in his review of Berkeley's work — *habitualiter* and *actualiter*. A notion is in the mind *actualiter* when it is actually conceived; it is in the mind *habitualiter* when *it can directly produce a conception*.<sup>10</sup> It is by virtue of mental association (we moderns should say), that things are in the mind *habitualiter*" (8.18). Thereby "mental association" is more than a simple association of ideas obeying the three principles of resemblance, contiguity and causality: "The association of ideas consists in this, that a judgement occasions another judgement, of which it is the sign. Now this is nothing less nor more than inference" (5.307) of which the three principles.

The third principle proposed by Peirce describes this continuous inferential process: it is a sign process. Every representation present to the consciousness is a sign. "Now a sign has, as such, three references: first, it is a sign to some thought which interprets it; second, it is a sign for some object to which in that thought it is equivalent; third, it is a sign, in some respect or quality, which brings it into connection with its object" (5.283). 1. When we think, the thought-sign is "always interpreted by a subsequent thought" without the possibility of interruption; if this were not so we would break the second principle according to which all cognitions are determined by a previous cognition. Therefore the advent of a new cognition is never an instantaneous affair, but is an "event occupying time, and coming to pass by a continuous process" (5.284). But of course this infinite continuity of the thought process, without a beginning or an end, is a continuity *a parte ante* logice, for thought has "a beginning in time" (5.311) and may come to "an abrupt and final end in death" (5.284). 2. "For what does the thought-sign stand — what does it name — what is its *suppositum*?" For a real outward thing, if one thinks of a real outward thing, replies Peirce. But still, as "the thought is determined by a previous thought of the same object, it only refers to the thing through denoting this previous thought." Thus if one thinks of General Toussaint,<sup>11</sup> "and [he is] first thought of as a negro, but not distinctly as a man. If this distinctness is afterwards added, it is through LEAVING THE CAVE

the thought that a *negro* is a *man*; that is to say, the subsequent thought, *man*, refers to the outward thing by being predicated of that previous thought, *negro*, which has been had of that thing. If we afterwards think of Toussaint as a general, then we think that this negro, this man, was a general. And so," concludes Peirce, "in every case the subsequent thought denotes what was thought in the previous thought" (5.285). 3. "The thought-sign stands for its object in the respect which is thought; that is to say, this respect is the immediate object of consciousness in the thought, or, in other words, it is the thought itself, or at least what the thought is thought to be in the subsequent thought to which it is a sign" (5.286).

Peirce then examines the properties which distinguish the sign from the thing signified: Its material qualities which belong to it in itself, its "*pure demonstrative application*" in relation to an object and its representative function in relation to a thought (5.287-290).

What stands out from this brief description of the third principle is that cognition is a continuous process, which implies that it is not instantaneous, but requires time, that it does not grasp an object directly, but rather invests it by means of other cognitions that precede it and follow it — in other words, cognition can only come about indirectly or mediately through thoughts which are signs. This is the very antithesis of the Cartesian theory of the immediate cognition of simple ideas.

With the fourth principle Peirce attacks another implication of Cartesianism, namely that the very reality of things is incognizable. To this Peirce replies that "the absolutely incognizable is absolutely inconceivable" (5.310): "Over against any cognition, there is an unknown but knowable reality; but over against all possible cognition, there is only the self-contradictory. In short, cognizability (in its widest sense) and being are not merely metaphysically the same, but are synonymous terms" (5.257). This leads Peirce to expound his conception of reality for the first time, which he later explained at greater length in his review of Berkeley's works. The statement of the fourth principle is also a reply to Cartesian dualism. After having said that "thought" is not an intuition and that "extension" is not incognizable, not only did Peirce have to explain what "extension" or nonself is, but also what "thought," the self is. He does this within the framework of a theory of the indetermination of the real, independently of its existence in things and of its conception in the mind. This theory, which has its source in a reading of Duns Scotus, comes close to the Jamesian conception of "pure experience" which will give rise to American neo-realism

whose main representative will be Ralph Barton Perry.

In negative terms the real is that which is not unreal or illusory. The notion of the real comes to us when, after an "error," we correct ourselves. In Positive terms, the real is that which mankind ends up agreeing to. "The real, then, is that which, sooner or later, information and reasoning would finally result in, and which is therefore independent of the vagaries of me and you (5.311). "This final opinion, then, is independent, not indeed of thought in general, but of all that is arbitrary and individual in thought; is quite independent of how you, or I, or any number of men think. Everything, therefore, which will be thought to exist in the final opinion is real, and nothing else" (8.12). This conception of the real is closely connected to the definition of thought as a temporal process, with all that this definition implies, to wit that this process is self-correcting and communal. To continue in Peirce's words "Thus, the very origin of the conception of reality shows that this conception essentially involves the notion of a COMMUNITY, without definite limits, and capable of a definite increase of knowledge. And so those two series of cognition — the real and the unreal — consist of those which, at a time sufficiently future, the community will always continue to re-affirm; and of those which, under the same conditions, will ever after be denied. Now, a proposition whose falsity can never be discovered, and the error of which therefore is absolutely incognizable, contains upon our principle, absolutely no error. Consequently, that which is thought in these cognitions is the real, as it really is. There is nothing, then, to prevent our knowing outward things as they really are, and it is most likely that we do thus know them in numberless cases, although we can never be absolutely certain of doing so in any special case" (5.311).

Given that "no cognition of ours is absolutely determinate, generals must have a real existence" (5.312). Peirce says, "... a realist is simply one who knows no more recondite reality than that which is represented in a true representation. Since, therefore, the word "man" is true of something, that which "man" means is real" (5.312). The nominalist is he who believes that beneath words there is "a thing in itself, an incognizable reality." "The great argument for nominalism is that there is no man unless there is some particular man. That, however, does not affect the realism of Scotus; for although there is no man of whom all further determination can be denied, yet there is a man, abstraction being made of all further determination" (5.312).

Consequently, that which is general is just as real as that which is con-

crete. "It is perfectly true that all white things have whiteness in them, for that is only saying, in another form of words, that all white things are white; but since it is true that real things possess whiteness, whiteness is real. It is a real which only exists by virtue of an act of thought knowing it, but that thought is not an arbitrary or accidental one dependent on any idiosyncrasies, but one which will hold in the final opinion" (8.14).

But it is plain that the reality of general things has no effect on the reality of concrete things which, in a way, acts as the model of the former: "Universals may be as real as singulars;"<sup>12</sup> "a thing in the general is as real as in the concrete" (8.14). "This theory is also highly favorable to a belief in external realities." Since "external" means simply "independent of what phenomenon is immediately present, that is of how we may think or feel" and "real" means "independent of how we may think or feel *about it*," it must be granted that "there are many objects of true science which are external, because there are many objects of thought which, if they are independent of that thinking whereby they are thought (that is, if they are real), are indisputably independent of all *other* thoughts and feelings" (8.13).

Thus a realist cannot be a dualist. "He will not, therefore, sunder existence out of the mind and being in the mind as two wholly improportionable modes. When a thing is in such relation to the individual mind that that mind cognizes it, it is in the mind; and its being so in the mind will not in the least diminish its external existence" (8.16).

But this theory of reality is fatal to the idea of a thing in itself, which is a thing whose existence is "independent of all relation to the mind's conception of it" (8.13). It does not forbid, but on the contrary, encourages us "to regard the appearances of sense as only signs of the realities," except on the condition that the realities which they represent should not be "the unknowable cause of sensation, but *noumena*, or intelligible conceptions which are the last products of the mental action which is set in motion by sensation" (8.13). These conceptions are necessary to reduce impressions to unity, but the latter are the "condition" of the former (1.549). "We have, it is true, nothing immediately present to us but thoughts. These thoughts, however, have been caused by sensations, and those sensations are constrained by something out of the mind" (8.12).

One might have expected Peirce to link sensations to qualities and in doing so give a real content to the first category (reference to a ground) in the same way as he had given the concrete to the second category (reference to a correlate) and the general to the third category (reference to an

interpretant). On this point his position remains "phenomenalist," that it be the phenomenalism of Kant rather than that of Hume does not change anything (8.15). Sensible qualities are not real in Peirce's sense: They refer to other realities, the noumena, of which they are the simple signs embodied in things. To say that "white things have whiteness in them" is another way of saying that "white things are white" (8.14). Therefore whiteness is the ground of white things, in other words, a third. One could even ask oneself why Peirce feels closer to Kant than to Hume, since he rejects Kantian intuition for a perception which is not as foreign as he considers it to be to empirical knowledge, if it were not that Kant is not, like Hume, a declared nominalist, his Copernican revolution marking precisely in Peirce's opinion "the passage from the nominalistic to the realistic view of reality" (8.15). "If materialism without idealism is blind — said the young Peirce in 1863 idealism without materialism is void."13 And this paraphrase of Kant is not a bad definition of Peirce's realist system in its complete form, in which each one of the categories corresponds to a real universe.

"Such being the nature of reality in general, in what does the reality of the mind consist?" (5.313), Peirce asks himself. His reply is that being a sign, man is a reality of the same sort as the one he has just described. There is no need to assign a particular reality to man. That I exist is a fact that proves indisputably the existence "of ignorance and error" (5.283). Then again, given that each time we think "we have present to the consciousness some feeling, image, conception, or other representation, which serves as a sign," it follows that "everything which is present to us is a phenomenal manifestation of ourselves," which does not prevent the phenomenon from existing outside us "just as a rainbow is at once a manifestation both of the sun and of the rain." When we think, then, we ourselves appear as a sign (5.283) which develops "according to the laws of inference" (5.313). The life of man is thereby comparable with the life of words in discourse, for "there is no element whatever of man's consciousness which has not something corresponding to it in the word" (5.314). "It is that the word or sign which man uses is the man itself. For, as the fact that every thought is a sign, taken in conjunction with the fact that life is a train of thought, proves that man is a sign; so, that every thought is an *external* sign, proves that man is an external sign. That is to say, the man and the external sign are identical, in the same sense in which the words homo and man are identical. Thus my language is the sum total of myself; for the man is the

#### LEAVING THE CAVE

thought" (5.314). But thought is a temporal and communal process (5.316). Man whose reality is asserted here is thus not the individual man whose existence separated from the general course of thought, "is manifested only by ignorance and error" (5.317); it is rather the man-thought-sign whose existence "now depends on what is to be hereafter," so that it has only "a potential existence, dependent on the future thought of the community" (5.316).

# 4. Grounds of validity of the laws of logic: The nature of reality and the social character of logic

The new conception of thought implies that nothing is inexplicable, not even the laws of thought that this conception presupposes. Isn't this a contradiction? It is in reply to this objection that Peirce devotes his last article of the 1868 series. Subsequently, Peirce examines the problem of the validity of deduction and of induction. To begin with he replies at length to the objections against syllogisms, he then proposes an answer to classical sophisms<sup>14</sup> and finally he affirms the validity of induction.

Peirce sets out the problem very clearly: "It will be said that my deduction of logical principles, being itself an argument, depends for its whole virtue upon the truth of the very principles in question; so that whatever my proof may be, it must take for granted the very things to be proven." But to this Peirce immediately replies that "I am neither addressing absolute sceptics, nor men in any state of fictitious doubt whatever. I require the reader to be candid; and if he becomes convinced of a conclusion, to admit it." A man may reason well without understanding the principles of reasoning "just as he may play billiards well without understanding analytical mechanics" (5.319).

Peirce maintains the validity of deduction and induction because the inferences allowed by these modes of thought correspond to the nature of reality. Thus statements of valid syllogisms "can all be deduced from the principle, that in a system of signs in which no sign is taken in two different senses, two signs which differ only in their manner of representing their object, but which are equivalent in meaning, can always be substituted for one another. Any case of the falsification of this principle would be a case of the dependence of the mode of existence of the thing represented upon the mode of this or that representation of it." This is "contrary to the nature of reality," says Peirce (5.323), for, to take up an illustration given by one

of Peirce's commentators, "If 'man is mortal' cannot be substituted for the true proposition 'animal is mortal' by virtue of the true proposition 'man is animal,' then the reality represented by 'man' would vary as it is represented by 'animal' or 'mortal,' which is the same as to deny objective reality."<sup>15</sup> Now, it is just this objectivity which defines reality in the new Peircean conception of reality.

While "the difficulty of showing how the law of deductive reasoning is true depends on our inability to conceive of its not being true," in the case of inductive reasoning the difficulty lies in imagining "how such a process can have any validity at all" (5.341). Peirce demonstrates that induction can be expected to be valid only if one professes a realist and not a nominalist (he says idealistic) theory of reality (5.353).

Induction enables us to know what we have not experienced: a whole class starting from some elements of that class, the future starting from the past. How is this possible? To the classical reply of the uniformity of the laws of nature, Peirce objects that nature is not regular. "It is true that the special laws and regularities are innumerable; but nobody thinks of the irregularities, which are infinitely more frequent" (5.342). And even if there were an orderliness in nature, it could never be discovered, for it would be the order of things taken either collectively or distributively. If collectively, it would be necessary to know a considerable portion of the whole, but we can never know how great the part we know is in relation to all that there is to know. If distributively, the order of nature would be the order of each of the things that constitute it, but in order to discover it, it must be possible to compare something which has it with something which does not have it. In one case as much as in the other, the order of nature cannot be known (5.343). But even if this order both existed and were known, this knowledge would be of use only as a general principle from which things could be deduced (5.344). Does this mean that nature is abandoned to chance? Just as we cannot imagine a universe in which all probable arguments will always be false, it is certainly necessary that some should be true. In such a case, "this would not be disorder, but the simplest order ... everything conceivable would be found in it with equal frequency." Finally, the validity of induction does not depend on the "particular constitution of the universe" (5.345), nor, as certain logicians have maintained, on the validity of deduction (5.346). Are we reduced to the absurd?

No, for the ultimate ground of logic is the social, and indeed moral nature of logic. All probable inference goes from the part to the whole. It

LEAVING THE CAVE

is essentially the same as statistical inference. I take a few handfuls of beans out of a bag containing white beans and black beans and from this sample I can judge approximately the proportions of black and white beans in the bag. Why is this type of inference valid? Because in the long run a white bean will be taken out as often as a black bean (5.349). The same is true of induction: "We cannot say that the generality of inductions are true, but only that in the long run they approximate to the truth." Hence, we cannot say that "we know an inductive conclusion to be true," but rather that "we only know that by accepting inductive conclusions, in the long run our errors balance one another" (5.350). Why is it that all human inductions are not erroneous? Because the real exists. "Now, since if there is anything real, then (on account of this reality consisting in the ultimate agreement of all men, and on account of the fact that reasoning from parts to whole, is the only kind of synthetic reasoning which men possess) it follows necessarily that a sufficiently long succession of inferences from parts to whole will lead men to a knowledge of it, so that in that case they cannot be fated on the whole to be thoroughly unlucky in their inductions" (5.351).

What follows from this for man? "That logic rigidly requires, before all else, that no determinate fact, nothing which can happen to a man's self, should be of more consequence to him than anything else. He who would not sacrifice his own soul to save the whole world, is illogical in all his inferences, collectively. So the social principle is rooted intrinsically in logic" (5.354).

This sacrifice gives a moral dimension to the ultimate foundation of logic and by the same token a moral reason for the validity of induction and of the new conception of the thought process. "But just the revelation of the possibility of this complete self-sacrifice in man, and the belief in its saving power, will serve to redeem the logicality of all men. For he who recognizes the logical necessity of complete self-identification of one's own interests with those of the community, and its potential existence in man, even if he has it not himself, will perceive that only the inferences of that man who has it are logical, and so views his own inferences as being valid only so far as they would be accepted by that man. But so far as he has this belief, he becomes identified with that man. And that ideal perfection of knowledge by which we have seen that reality is constituted must thus belong to a community in which this identification is complete" (5.356).

### Chapter two

# The Eclipse of the Sun (1870-1887)

#### 1. Journeys and professional activities

In 1868, Peirce left the Cave moving in the direction indicated to him by Kant, under the guidance of Duns Scotus. From 1870 to 1887 Peirce was to travel through the world in search of the sun in its reflections. And this is more than just a rhetorical figure, for, having been appointed Assistant of the Harvard Observatory in 1869, the following year Peirce was sent to Europe by the U.S. Coast and Geodetic Survey to observe the eclipse of the sun on 22 December 1870. This first sojourn enables him to journey through Greece and Italy in search of a favorable site for his observations. His choice was finally to fall upon Catania in Sicily. But, in the meantime, as Max Fisch has very rightly pointed out, he discovers ancient Greece brought to life again by Schliemann's archeological excavations in 1870, the same year in which papal infallibility was proclaimed in Rome. It is this first sojourn that Peirce has in mind when he gives the name of "Arisbe" to his home in Milford and maintains his thesis of fallibility.

Peirce was to sojourn in Europe again on behalf of the Coast and Geodetic Survey in 1875-1876, 1877, 1880 and 1883. In 1875, he was the first American delegate at the International Geodetic Conference in Paris. Peirce there reported the findings of his work on the pendulum. During his sojourn in Paris, which continued through to July 1876, Peirce calculated the value of gravity-determinations. In 1877, he represented America again at the International Geodetic Conference held at Stuttgart where he read a paper on "the effect of flexure of the Repsold stand on the oscillations of the reversible pendulum." During the whole time he worked for the Geodetic Survey, he never ceased publishing memoirs, observations, studies and papers, held at congresses in the United States and elsewhere,

on questions relating to his professional activities: A review of the 1870 eclipse of the sun, the calculation of latitude and then of longitude, numerous experiments on the pendulum, the determination of gravity; he perfected instruments for observation and measurement and proposed theories on "stellar photometry" (1872), on the form of the Milky Way (*Photometric Researches*, 1878) and on the new standard meter: "The spectrum meter" (1882).

Peirce was accompanied on his first two journeys to Europe by his wife Melusina Fay who left him in 1875 to return to the United States. He lived apart from her until his divorce and marriage, in 1883, to Juliette Annette Pourtalais, a young woman of French nationality who immediately left for Europe with him. Peirce had known her at least since 1878 and may have met her in Paris or New York the previous year. Juliette was to be his companion during the period of the revival of Greek cosmology, of the sun set free.

But on leaving the Cave, Peirce initially still only contemplated the reflections of the sun in the mirror of mathematics: The logical reflections of the calculation of relations (1870), methodological reflections of the theory of science (1871-1879), reflections of pure mathematics and of mathematical logic (1879-1885), to which his teaching in logic at the Johns Hopkins University (1879-1884) gives a fascinating brilliance. However, this brilliance was dimmed by his discovery of Greek cosmology which directs him back to the sun.

#### 2. Formation of the logic of relations and the new conception of propositions

It is a fact<sup>16</sup> that Peirce took an interest in the logic of relations before reading De Morgan in 1866, even if he saw the epistemological implications only after having written his "Description of a Notation for the Logic of Relatives" in 1870, and the phenomenological implications only after having written his study on "the algebra of logic" in 1885.

In his 1866 Lowell Lectures, Peirce distinguishes two types of relations: relations of equiparence and relations of disquiparence which in his 1867 article "On a New List of Categories" he will call respectively relations of "concurrence" and relations of "opposition." The first is that of relates whose reference to a ground is a "prescindable" or internal quality and the

second is that of relates whose reference to a ground is an "unprescindable" or relative quality (1.558). Monadic propositions belong to the first category, dyadic propositions to the second. By "dyadic proposition," Peirce means such propositions as "all men love those who love him" where "all men" is the subject, "love" the predicate and "those who love him" the object. Hence, a proposition of disquiparence has three terms instead of two. In the same way Peirce examines propositions involving such expressions as "lighter than," "heavier than," "less than," "more than," "murdered," "is murdered by." In the propositions of disquiparence, it is therefore necessary to distinguish between active propositions and passive propositions.

Later, in 1895, Peirce was to say that in his 1867 paper he committed an error in "identifying those relations constituted by non-relative characters with relations of equiparence, that is, with necessarily mutual relations, and the dynamical relations with relations of disquiparence, or possibly non-mutual relations" (1.567). In his 1870 article, he still seemed to maintain the same distinction. "The character which is signified by a concurrent relative is an absolute character, that signified by an opponent is a relative character, that is, one which cannot be prescinded from reference to a correlate" (3.336). But in this article the proposition is no longer described as being formed by a subject, a copula and a predicate, but as being a transitive relation of inclusion:

If 
$$x \rightarrow y$$
,  
and  $y \rightarrow z$ ,  
then  $x \rightarrow z$ . (3.47)

Hence the syllogism depends "upon the transitive character of these relations." Indeed, it is by virtue of the transitive character of these relations that

"from	$f \rightarrow m$
and	$m \rightarrow a$ ,
we can infer that	$f \rightarrow a;$

that is, from every Frenchman being a man and every man being an animal, that every Frenchman is an animal" (3.66).

Absolute terms have been replaced by relations. Peirce says this expressly at the beginning of his article when he proposes to develop Boole's notation, which Boole himself had only applied to "the logic of absolute terms," to De Morgan's logic of "relative terms" (3.45).

#### 3. Theory of research

Peirce drew an initial conclusion from the new conception of thought imposed upon him by the logic of relations in his 1871 review of Berkeley's works, and in his 1877-1878 articles on the theory of science. This conclusion appears within the context of his research on the nature of scientific method. It was probably made the object of discussion during the meetings of what Peirce ironically called the "Metaphysical Club"<sup>17</sup> at Cambridge, sometimes held in James' study, sometimes in Peirce's, and whose existence was shortlived. These meetings took place between 1870 and 1874 and the discussions as to what pragmatism was to be probably took place towards the end of 1872 and the beginning of 1873. In any case, it is certainly in this context that the theory of research or of scientific inquiry was formulated, if only because of the direct or indirect influence exerted upon Peirce by Chauncey Wright and Nicholas St. John Green, as catalysts of his own ideas.

Chauncey Wright refused to apply his conception of science to anything but science itself, whose "neutrality" he keenly defended against James and Peirce. But it is not difficult to see what a philosopher could draw from this notion and what Peirce did in actual fact draw from it on applying it to the nature of ideas in general. In Wright's words, "The objective method is verification by sensuous tests, tests of sensible experience a deduction from theory to consequences, of which we may have sensible experiences if they be true."<sup>18</sup> "The ideas on which mathematical mechanics and the calculus are founded, the morphological ideas of natural history, and the theories of chemistry are such working ideas — finders, not merely summaries of truth...".<sup>19</sup>

Nicholas St. John was the first to draw the attention of the Club's members upon Bain's theory of belief, about which Peirce was to say that "pragmatism is scarce more than a corollary" (5.12). According to Bain, "belief is a primitive disposition to follow out any sequence that has been once experienced, and to expect the result."<sup>20</sup>

Another topic of discussion was the theory developed by Darwin in *The Origin of Species*. Even though James adopts Darwinism because it authorizes one to think, differently from Lamarckism, that man is independent, at least in part, of his heredity, Peirce is more reticent. He does not accept Darwin's theory by itself: He completes it with Lamarck's views and with the "cataclysmic" conception of evolution. He does not accept it as

such: it is as an element of his logic of probabilities that he welcomes it. Peirce was in fact the first to emphasize the importance of the notion of chance in the Darwinian theory and to extend it to the statistical conception of law, something which Darwin himself had not done (5.364).<sup>21</sup>

The articles which appeared in *The Popular Science Monthly* in 1877 and 1878 under the title "Illustrations of the Logic of Science" thus develop ideas discussed during the meetings of the Metaphysical Club. Like those of 1868, they are anti-Cartesian. In the first, Peirce attacks those who wish to begin from a universal doubt, even if it were methodological, and in the second, he asks himself how to make our ideas clear, those ideas whose clarity was evident to Descartes. These two articles appeared in French in the *Revue philosophique* in 1878 and 1879.<sup>22</sup> Peirce had written the second directly in French on the ship that took him to Europe for the third time, and in it he expounds for the first time his pragmatic conception of knowledge. This series of articles, in fact, is an introduction to the study of the problem of induction, which constitutes the principal argument of the articles.

The first is entitled, "The Fixation of Belief." Man has a natural propensity to believe. It is a habit which determines our actions (5.371) and which constitutes the guiding principle of inference (5.367). Yet doubt sometimes troubles the "calm and satisfactory" state of belief (5.372). Then "the irritation of doubt causes a struggle to attain a state of belief" (5.374). Peirce calls this struggle for the rediscovery of belief, "inquiry." It is a search. "With the doubt, therefore, the struggle begins, and with the cessation of doubt it ends" (5.375). But this doubt cannot be doubt as intended by Descartes. "Some philosophers have imagined that to start an inquiry<sup>23</sup> it was only necessary to utter a question whether orally or by setting it down upon paper, and have even recommended us to begin our studies with questioning everything! But the mere putting of a proposition into the interrogative form does not stimulate the mind to any struggle after belief. There must be a real and living doubt, and without this all discussion is idle" (5.376). In his second 1868 article, Peirce had already raised the problem of universal doubt. "We cannot begin with complete doubt. We must begin with all the prejudices which we actually have when we enter upon the study of philosophy. These prejudices are not to be dispelled by a maxim, for they are things which it does not occur to us *can* be questioned. Hence this initial skepticism will be a mere self-deception, and not real doubt; and no one who follows the Cartesian method will ever be satisfied

until he has formally recovered all those beliefs which in form he has given up (...). A person may, it is true, in the course of his studies, find reason to doubt what he began by believing; but in that case he doubts because he has a positive reason for it, and not on account of the Cartesian maxim. Let us not pretend to doubt in philosophy what we do not doubt in our hearts" (5.265).

There are a number of different ways to dispel the irritation of doubt and to reach belief. Peirce enumerates four: the method of tenacity, the method of authority, the a priori method and the scientific method. The first consists in wanting to believe so as to attain the peace of mind that belief procures. This method "will be unable to hold its ground in practice," for "the social impulse is against it" (5.378). The second method substitutes the will of the individual for that of the state (5.379). It is very effective. But just as no social organization can regulate everybody's opinions in every detail, upon every subject, "men's minds must be left to the action of natural causes. This imperfection will be no source of weakness so long as men are in such a state of culture that one opinion does not influence another." But when they do react upon each other, those who possess "a wider sort of social feeling" will see that "men in other countries and in other ages have held to very different doctrines from those which they themselves have been brought up to believe." And this will give rise to "doubts in their minds" (5.381). The third method does not only produce an impulse to believe, it also determines what propositions we are to believe: those which are "agreeable to reason." "Plato, for example, finds it agreeable to reason that the distances of the celestial spheres from one another should be proportional to the different lengths of strings which produce harmonious chords" (5.382). But this method "makes of inquiry something similar to the development of taste." And so from this a priori method "we are driven ... to a true induction" which is the scientific method of inquiry (5.383).

The three methods rejected by Peirce are not cited by chance: the first belongs to the order of the sentiment, the second to the order of facts, the third to the order of reason. But such reason partakes at one and the same time of the nature of the sentiment: it is "the development of taste" and thereby it decides "what proposition it is which is to be believed" without there being a proper inquiry. Hence this is not the sort of reason which acts as the guiding principle of inference or of induction. It is the reason of the *a priori* philosophy of intuition and not of scientific philosophy.

The fundamental postulate of the scientific method of thinking is the same as that which is at the basis of the Peircean conception of reality:

"There are Real things, whose characters are entirely independent of our opinions about them; those Reals affect our senses according to regular laws, and, though our sensations are as different as are our relations to the objects, yet, by taking advantage of the laws of perception, we can ascertain by reasoning how things really and truly are; and any man, if he have sufficient experience and he reason enough about it, will be led to the one True conclusion" (5.384).<sup>24</sup>

Do we not have a vicious circle here, given that we arrive at this conception of reality through the scientific method of inquiry while the scientific method itself rests upon his very conception of reality? Peirce replies in the following way:

"1. If investigation cannot be regarded as proving that there are Real things, it at least does not lead to a contrary conclusion; but the method and the conception on which it is based remain ever in harmony. No doubts of the method, therefore, necessarily arise from its practice, as is the case with all the others.

"2. The feeling which gives rise to any method of fixing belief is a dissatisfaction of two repugnant propositions. But here already is a vague concession that there is some *one* thing which a proposition should represent. Nobody, therefore, can really doubt that there are Reals, for, if he did, doubt would not be a source of dissatisfaction. The hypothesis, therefore is one which every mind admits. So that the social impulse does not cause men to doubt it.

"3. Everybody uses the scientific method about a great many things, and only ceases to use it when he does not know how to apply it.

"4. Experience of the method has not led us to doubt it, but, on the contrary, scientific investigation has had the most wonderful triumphs in the way of settling opinion.

"These — Peirce concludes — afford the explanation of my not doubting the method or the hypothesis which it supposes; and not having any doubt, nor believing that anybody else whom I could influence has, it would be the merest babble for me to say more about it. If there be anybody with a living doubt upon the subject, let him consider it" (5.384).

The second anti-Cartesian article is entitled "How to Make Our Ideas Clear." Intuition does not put us into a position to distinguish between an idea "seeming clear" and an idea "really being so" (5.391). The clearness of an idea is a mere sentiment of familiarity with that idea "a subjective feeling of mastery which may be entirely mistaken" (5.389). Thus it is necessary to

find another method more reliable than the *a priori* method resorted to by Descartes. "Trusting to introspection, as he did, even for a knowledge of external things, why should he question its testimony in respect to the contents of our own minds?" Moreover, he recognized that clearness of ideas was not sufficient and that ideas must also be distinct, that is, says Peirce, "they must sustain the test of dialectical examination; that they must not only seem clear at the outset, but that discussion must never be able to bring to light points of obscurity connected with them" (5.391); which, all things considered, only amounted to postponing or shifting the problem.

What was said previously indicates the direction in which we should search for this new method. The irritation of doubt puts thought into action and belief puts an end to it: "So that the production of belief is the sole function of thought" (5.394), where thought is conceived as a process "having beginning, middle, and end" (5.395). Belief has three properties: "First, it is something that we are aware of; second, it appeases the irritation of doubt; and, third, it involves the establishment in our nature of a rule of action, or, say for short, a *habit*." It is thought in its three forms of acquired knowledge first, thought at rest second, "although thought is essentially an action" and "the *final* upshot of thinking" no longer belongs to thought (5.397), and a rule of action or habit third (5.398).

The essential mark of belief is obviously the establishment of a habit which, as we saw in the review of Berkeley's works, is a "positively indeterminate" species intelligibilis, in itself neither universal nor singular, but "universal in the mind, singular in things out of the mind" and which can directly produce a conception (8.18). So conception is the product of habitual action and there are as many conceptions as there are modes of action. This leads to Peirce's proposal of a method for distinguishing between one conception and another: "Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object" (5.402). Consequently, if the modes of action which produce beliefs do not differ, in reality we are not dealing with different beliefs. The distinctions drawn between them are often imaginary (5.398). It is owing to a similar kind of error that we mistake "a mere difference in the grammatical construction of two words for a distinction between the ideas they express" (5.399). This is the form Peirce uses for his pragmatic maxim which he presented for the first time in 1871. "Do things fulfil the same function practically? Then let them be signified by the same word. Do they not? Then let them be distinguished. If I have learned a formula in gibberish which in any way jogs my memory so as to enable me in each single case to act as though I had a general idea, what possible utility is there in distinguishing between such a gibberish and formula and an idea? Why use the term *a general idea* in such a sense as to separate things which, for all experiential purposes, are the same?" (8.33).

To know the meaning of an idea "we have, therefore, simply to determine what habits it produces," for the meaning of a thing "is simply what habits it involves." What the habit is depends on what sets it in action at a given moment: perception, and on the ways in which it acts. "Every purpose of action is to produce some sensible result." "Thus, we come down to what is tangible and conceivably practical, as the root of every real distinction of thought, no matter how subtile it may be; and there is no distinction of meaning so fine as to consist in anything but a possible difference of practice" (5.400).

Peirce says that his pragmatic maxim, quoted above, is "the rule for attaining the third grade of clearness of apprehension" (5.402). Peirce does not contest that there exists a first and second grade of clearness. Let us take, for example, the idea of reality. The first grade of clearness being the sense of familiarity that one has with this idea, no idea could be more familiar than that of reality (5.405). As for clearness in its second grade, we may define the real as "that whose characters are independent of what anybody may think them to be." But, however satisfactory such a definition may seem to be, "it would be a great mistake to suppose that it makes the idea of reality perfectly clear." All we need to do is apply the pragmatic maxim to it to be convinced of this. At third grade of clearness, "reality, like every other quality, consists in the peculiar sensible effects which things partaking of it produce." The only effect of real things being that of causing belief in the real) distinguished from false belief (or belief in fiction)" (5.406).

The methods of tenacity and authority may resolve the question for a while, but, as we have seen, the day comes when the doubt appears as the result of the diverging of opinions. Descartes and the followers of the *a priori* movement believed that it was enough to convince through recourse to disputation in order to solve the difficulty, in other words to inquire "what belief is most in harmony with their system." It was a very feeble conception of truth (5.406), and certainly not the method used by men of science. Their methods of investigation may vary, the results they obtain may be very different, but as the investigation advances they are carried by

"a force outside of themselves to one and the same conclusion (...). This great hope is embodied in the conception of truth and reality. The opinion which is fated to be ultimately agreed to by all who investigate, is what we mean by the truth, and the object represented in this opinion is the real." Such is the pragmatic method thanks to which we arrive at the third grade of clearness.

It may be objected, says Peirce, that the third grade of clearness leads to a view of reality directly opposed to that which the second grade of clearness had led us to conceive. In fact, the latter is abstract and the former concrete or better still "pragmatic." Reality, of course, is independent of individual thoughts, but not of thought in general (5.408). An individual can make an error, the State can impose erroneous beliefs "by the fagot and the rack" (8.16) and the race could disappear before we become aware of the error contained by our beliefs, for, as long as we do not doubt them our beliefs are true "and, indeed, it is a mere tautology to say so" (5.375). But, "if, after the extinction of our race, another should arise with faculties and disposition for investigation, that true opinion must be the one which they would ultimately come to," for, though the object of the final opinion depends on what that opinion is, "yet what that opinion is does not depend on what you or I or any man thinks" (5.408).

Truth and reality are the outcome of a common enterprise, as Peirce had already said in 1868, and more particularly of the community of scientists all working on the same investigation; the results of which may in part contain errors — and this element of error is an integral part of the very search for truth, given that it is the work of man (5.317) — but this does not affect in any way the reality of that which is real which depends on the real fact that "investigation is destined to lead, at last, if continued long enough, to a belief in it" (5.409).

The question has been asked whether there was not some paradox in maintaining that "nothing can remain ultimately unknowable only if an ultimate unknowable fact is assumed, viz., the indefinite continuation of intellectual inquiry."<sup>25</sup> We do not think so for two reasons. The first, as we have seen, is that the very idea of the unknowable is contradictory, the second is that investigation is not pursued *in abstracto* in an imaginary future, but rather in a real present where it is never a question of knowing what things would be if they were different, for the idea of the possible is not necessarily connected to time: The possible is not a future. The problem of the nature of the possible is perspected, but at this stage in his thought Peirce

has not yet solved it. It is true that in this connection he is still a "nominalist." The pragmatic articles of 1877 and 1878 even marked on the whole a step backwards with respect to the 1868 articles. At that time Peirce was a "nominalist" in the Kantian sense, now he is a "nominalist" in Hume's sense. The theory of investigation is a quasi-phenomenological version of the theory of knowledge through signs. But there is more to it, and this is not what must be retained of the pragmatic conception of the nature of ideas which Peirce connects with Kant and not with Hume (5.412). Nevertheless, it is a fact that he affirms "how impossible it is that we should have an idea in our minds which relates to anything but conceived sensible effects of things" and that "our idea of anything is our idea of its sensible effects," that "the occasion of such action would be some sensible perception," whose purpose is "to produce some sensible result" (5.401).<sup>26</sup> It is only when Peirce sets aside the problem of the nature of firsts that all traces of nominalism disappear, at the same time as the solution to the problem of the nature of the possible appears in the last revision of his theory of categories which he seems to have abandoned for the moment.

For the moment however Peirce had other concerns. In the conclusion to the English text of "How to Make Our Ideas Clear," Peirce writes that it is not sufficient to say how to make our ideas clear, it is also necessary to say what exactly should be done in order that they be true. To attain this, he says, it is necessary to cross "the threshold of scientific logic" (5.410). And this is exactly what he does in the remaining articles of the series devoted to the logic of science. As we said at the beginning, that which is under examination is the nature of induction or inductive inference which is the logical form that invests or should invest all thought processes.

The fundamental question concerns the new relation between thought and nature implied in the theory of investigation. Are the laws of thought laws of nature? What place does chance occupy in the universe? Is continuity a category of thought or of the world? Peirce does not give us here a definitive solution to these problems. Nevertheless he is convinced that the solution exists and that it must be searched for in a new theory of probability conceived as "a continuous quantity" (2.648). This is the theory he expounds in his "Doctrine of Chances" and which is at the basis of all the other articles of the series: "The Probability of Induction," "The Order of Nature," "Deduction, Induction and Hypothesis" and another 1883 article "A Theory of Probable Inference."

Peirce intends to clarify the notion of probability by applying the prag-

matic maxim to it. He asks himself "what real and sensible difference there is between one degree of probability and another" (2.649). And he replies that "in the frequent employment of two different modes of inference, one will carry truth with it oftener than the other. It is evident that this is the only difference there is in the existing fact. Having certain premisses, a man draws a certain conclusion, and as far as this inference alone is concerned the only possible practical question is whether that conclusion is true or not, and between existence and non-existence there is no middle term." We saw, in fact, that "the distinction of reality and fiction depends on the supposition that sufficient investigation would cause one opinion to be universally received and all others to be rejected." The probability of a mode of inference is therefore "the proportion of cases in which it carries truth with it" (2.650) in given conditions (2.651).

As Peirce was later to reject it, there is no point in further examining his theory of probability and the theory of induction from which it is inseparable. Nevertheless, it is important for our own purposes that we explain why he abandoned it. When, in 1910, Peirce re-examined his 1878 article on the "doctrine of chances," he recognized two merits in it, that of insisting on the social nature of logic (something he had already done and even better so in 1868) and that of having said "that probability never properly refers immediately to a single event, but exclusively to the happening of a given kind of event on any occasion of a given kind," but, he adds, "when I come to define probability, I repeatedly say that it is the quotient of the number of occurrences of the event divided by the number of occurrences of the occasion. Now this is manifestly wrong, for probability relates to the future; and how can I say how many times a given die will be thrown in the future? To be sure I might, immediately after my throw, put the die in strong nitric acid, and dissolve it, but this suggestion only puts the preposterous character of the definition in a still stronger light. For it is plain that, if probability be the ratio of the occurrences of the specific event to the occurrences of the generic occasion, it is the ratio that there would be in the long run, and has nothing to do with any supposed cessation of the occasions. This long run can be nothing but an endlessly long run; and even if it be correct to speak of an infinite "number," yet  $\frac{\infty}{\infty}$  (infinity divided by infinity) has certainly, in itself, no definite value" (2.662). The theory of probabilities therefore does not account for possibles, for the first category, which, as we have seen, was to be important for the theory of investigation and hence for inductive inference in explaining these things other than through recourse to time.

Such recognition of the reality of possibles was to be equally necessary in finally settling the question of the order of nature and of the place of chance and of continuity in the universe. In his 1878 article entitled "The Order of Nature," Peirce merely set forth the problem. But the interest of this article lies in the fact that it constitutes the first Peircean approach to a scientific metaphysics or "cosmology." In his last article of the 1868 series Peirce, as we have seen, seemed to have rejected the hypothesis of the order of nature without however opting for a universe given over to chance. Peirce here justified his position within the framework of his nondualist theory of investigation. We do not have the world, on the one hand, and man trying to discover its composition, on the other. Man is a living being and, as such, he is part of the universe. There is no need, therefore, to study the nature of things abstractly, independently of living beings, but on the contrary it is necessary "to consider the character of things as relative to the perceptions and active powers of living beings," man included. Consequently a world of chance "is simply our actual world viewed from the standpoint of an animal at the very vanishing-point of intelligence" and "the interest which the uniformities of Nature have for an animal measures his place in the scale of intelligence" (6.406). The validity of induction does not depend, as Mill thought, on the uniformities of the laws of nature, but on the fact that man chooses the character to be studied before examining a sample. "If the character be not previously designated, then a sample in which it is found to be prevalent can only serve to suggest that it may be prevalent in the whole class," and not that it actually is. Induction is "the inference that a previously designated character has nearly the same frequency of occurrence in the whole of a class that it has in a sample drawn at random out of that class" (6.409). If the uniformity of nature, Peirce remarks, were the sole warrant of induction, "we should have no right to draw one in regard to a character whose constancy we knew nothing about" (6.412). The principle of causality, according to which there is no effect without a cause, is of no greater value than that of the uniformity of nature. Though there exists a cause for each effect and that of a kind which is capable of being discovered, "yet if there be nothing to guide us to the discovery" of this cause, "then the discovery would have no chance of ever getting made" (6.415). "It seems incontestable, therefore, that the mind of man is strongly adapted to the comprehension of the world; at least, so far as this goes, that certain conceptions, highly important for such a comprehension,

naturally arise in his mind; and, without such a tendency, the mind could never have had any development at all" (6.417).

Where does this tendency come from? Peirce asks himself. Probably, he replies, from "natural selection" about which we may say as a conclusion to our examination of the 1878 articles that the new theory of investigation is the most coherent methodological and metaphysical expression, if not yet the most perfect. For this we will have to wait for Peirce to grant to chance in his metaphysics and to abduction in his methodology the place that will bring them back into harmony with the continuity of the evolutionary process of the rationalization of the universe.

#### 4. Mathematics and symbolic logic

The 1877-1878 articles represent Peirce's most elaborate philosophical work from 1870 to 1887. Furthermore, it must also be observed that these articles develop ideas set forth and discussed during the meetings held by the Metaphysical Club, in 1873 at the latest. During all these years in fact Peirce seems to have lost interest in philosophy, devoting himself almost exclusively, outside his professional interests, to mathematics and to logic, especially from 1879 onwards when he was appointed lecturer in logic at the Johns Hopkins University in Baltimore.

We must remember that for the Peirces mathematics was a family affair; Peirce's father, Benjamin Peirce and his brother James Mills were both mathematicians. Charles Peirce's attraction for chemistry was no less a determining factor in his new mathematical conception of logic, even if his starting point was Boole's calculus. Peirce was strongly impressed by the use made by James Joseph Sylvester, who also taught at the Johns Hopkins, of chemical diagrams for the representation of logical reasonings.<sup>27</sup> Peirce himself was also to use them systematically, giving them their crowning expression in his existential graphs.

Peirce does not separate mathematical thought from his symbolic logic. Thus, as to the period we are dealing with, we find it essentially in his logical writings and particularly in his 1870 article "Description of a Notation for the Logic of Relatives" (3.45-149) and in his 1885 article "On the Algebra of Logic: A Contribution to the Philosophy of Notation" (3.359-403). The problem raised by Peirce concerns the nature of mathematics: Is it deductive or inductive? He was to return to the subject later. His treat-

ment of it here, ambiguous as it may be, reveals, in itself, the difficulty already repeatedly met with in the course of the present period, deriving from the fact that Peirce continues to maintain a nominalist position as regards the nature of firsts. People have long wondered, says Peirce, how it is possible that "on the one hand, mathematics is purely deductive in its nature, and draws its conclusions apodictically, while on the other hand, it presents as rich and apparently unending a series of surprising discoveries as any observational science." The reason for this is that all deductive reasoning involves an "element of observation:" "deduction consists in constructing an icon or diagram the relation of whose parts shall present a complete analogy with those of the parts of the object of reasoning" and involve a mental experiment of that image of which the result may reveal "unnoticed and hidden relations among the parts" (3.363). Is mathematics inductive?

Given that Peirce still relates icons to particulars and not to possibles, he is obliged to make a detour to convince even himself of this. Mathematics is apparently inductive. The geometrician draws figures; in algebra one assumes that a letter represents a "given quantity." But, says Peirce, "while the mathematician supposes an individual case, his hypothesis is yet perfectly general, because he considers no characters of the individual case but those which must belong to every such case" (3.92). Returning to the scholastic distinction between *individuum signatum* (such and such a man: Julius Caesar) and individuum vagum (a certain man, no matter who), and specifying that "if we call a thought about a thing in so far as it is denoted by a term, a second intention, we may say that such a term as 'any individual man' is individual by second intention," Peirce concludes: "The letters which the mathematician uses (whether in algebra or in geometry) are such individuals by second intention" and "all the formal logical laws relating to individuals will hold good of such individuals by second intention, and at the same time a universal proposition may at any moment be substituted for a proposition about such an individual, for nothing can be predicated of such an individual which cannot be predicated of the whole class" (3.94). The reason for this will become more evident when firstness accedes to the dignity of reality whose generality the icon will share in its relation with an object second.26

In these same articles Peirce describes the new logic that he developed through the use of mathematical symbols. To these should be added, besides his 1867 article, "On an Improvement in Boole's Calculus of Logic"

(3.1-19), studies which include: An unpublished paper of 1880 "A Boolian Algebra with One Constant" (4.12-20), another article "On the Algebra of Logic" (3.154-251), which is also of 1880; a pamphlet of 1882 *Brief Description of the Algebra of Relatives* (3.306-322) and a note in the 1883 *Studies in Logic* (3.328-358) co-authored by members of the Johns Hopkins University. Though the symbols proposed by Peirce were not retained in logic, his studies, as we said at the beginning, mark a decisive step in the history of logic. More explicitly, we may subdivide Peirce's contributions according to the four headings of Boolian logic: The logic of relatives, predicative logic or the logic of terms, and propositional logic.

Boolian Logic. We have already indicated, as regards the new conception of the proposition, one of the improvements brought to Boole's calculus: The introduction of the notion of inclusion and of the symbol "—<" with which to express it. This notion had been preceded by the substitution of alternative disjunction for exclusive disjunction. Both the sign of equality with a comma beneath it to express numerical identity ( $\Rightarrow$ ) (3.2); as well as a +, b to denote all the individuals contained under a and b together. "The operation here performed will differ from arithmetical addition in two respects: First, that it has reference to identity, not to equality; and second, that what is common to a and b is not taken into account twice over, as it would be in arithmetic." This operation that Peirce calls "logical addition" is "both commutative and associative:"

and

$$a +, b = b +, a$$

$$(a +, b) +, c = a +, (b +, c)^{"} (3.3)^{29}$$

Two important innovations must be retained from the unpublished 1880 text. Firstly: In Peirce the substitution of nouns by propositions marks the starting point of propositional logic. The latter entails a new definition of the sign of inclusion "—<," present in an article published in that same year. "The symbol "—<" is the copula, and signifies primarily that every state of things in which a proposition of the class  $P_i$  is true is a state of things in which a propositions of the class  $C_i$  are true." Peirce wrote this as follows:

$$P_i - C_i$$

("Here  $P_i$  denotes any one of the class of premisses, and  $C_i$  the corresponding conclusion") (3.165). Thus Peirce passes from inclusion to implication. The second innovation is the demonstration, some thirty years before Shef-

fer, that all Boolian operations can be reduced to the negation of the alternative disjunction "either ..... or .....," thus economizing on all operative symbols: "I begin with the description of the notation for conditional or 'secondary' propositions. The different letters stand for propositions. Any one proposition written down by itself is considered to be asserted. Thus,

#### A

means that the proposition A is true. Two propositions written in a pair are considered to be both denied. Thus,

#### A B

means that the propositions A and B are both false; and

#### A A

means that A is false." Furthermore, Peirce specifies that he makes use of "commas, semicolons, colons, periods, and parentheses, just as [in] chemical notation, to separate pairs which are themselves paired" (4.13).

The Logic of Relatives and of Terms. The essential texts on the logic of relatives and of terms are those of 1882, 1883 and 1885. We are examining the logic of relatives and of terms together because Peirce first applied the notion of quantifier to the logic of relations and then he introduced it into the logic of terms, and also because he considers identity to be a kind of relation between objects rather than between terms.

The discovery of the theory of quantification was the common work of Peirce and one of his students at the Johns Hopkins, Oscar Mitchell. "All attempts to introduce this distinction into the Boolian algebra were more or less complete failures," writes Peirce, "until Mr. Mitchell showed how it was to be effected. His method really consists in making the whole expression of the proposition consist of two parts, a pure Boolian expression referring to an individual and a Quantifying part saying what individual this is. Thus, if k means 'he is a king,' and h, 'he is happy,' the Boolian formula (where the dash above the letter indicates that the proposition has been negated)

### $(\bar{k} + h)$

means that the individual spoken of is either not a king or is happy. Now, applying the quantification, we may write

Any 
$$(k + h)$$

to mean that this is true of any individual in the (limited) universe, or

Some 
$$(k + h)$$

to mean that an individual exists who is either not a king or is happy. So

Some (kh)

means some king is happy, and

Any (kh)

means every individual is both a king and happy." And in order to render the notation "as iconical as possible," Peirce suggests that we use  $\Sigma$  for "some" which suggests a sum, and  $\Pi$  for "all" which suggests a product (3.393).

If  $l_{ii}$  means that *i* is a lover of *j*, and  $b_{ii}$  that *i* is a benefactor of *j*. Then

$$\prod_{i} \sum_{j} a_{ij} b_{ij}$$

means that everything is at once a lover and a benefactor of something (3.394).

With the exception of  $\Pi$  and  $\Sigma$ , Peirce had already proposed this notation for the logic of relatives which he enriched through the introduction of quantifiers. Thus from the very outset, Peirce had a clear notion of the relation where the terms related appeared as indices:  $I_{ij}$  means that an individual *i* is a lover of *j* (3.394); with his classifications in reflexive relative as, for example, in the relative in which an individual *i* loves himself ( $a_{ii}$ ), converse where the order of the members of the pair is reversed (3.330), dual and plural (3.219), etc.; with all his combinative operations: Addition and multiplication "subject to the associative law" (3.334).

To express identity, Peirce adopts a symbol of second intention: 1. Thus he writes  $I_{ij}$ . But this relation of identity has peculiar properties. The first is that if *i* and *j* are identical, whatever is true of *i* is true of *j*. This may be written as follows:

$$\Pi_{i} \Pi_{i} \{ I_{ii} + \bar{x}_{i} + x_{i} \}$$

Another property is that if everything which is true of i is true of j, then i and j are identical. This may be written as follows:

$$I_{ij} = \Pi_x \left( x_i x_j + \bar{x}_i \bar{x}_j \right) (3.398)$$

*Propositional Logic.* Peirce and Frege discovered propositional logic almost simultaneously, but the anteriority of Frege's discovery is beyond doubt for his first version of propositional calculus dates back to 1879. Peirce's first systematic statements on "the algebra of logic" date back to 1880 and 1885.
They contain the notion of truth value, the idea of a logic with only one function, the Philonian implication, a system of axioms, and other intuitions or anticipations which were to be clarified later such as the ideas of formal implication (1896), of truth tables (1902) and of what is called the Sheffer function (1902).

Truth values. Let propositions be represented by quantities. "Let v and f be two constant values, and let the value of the quantity representing a proposition be v if the proposition is true and be f if the proposition be false. Thus, x being a proposition, the fact that x is either true or false is written

So

(x - f)(v - y) = 0

(x - f)(y - x) = 0

will mean that either x is false or y is true" (3.366). This notation applies perfectly to the syllogism. "Thus, take the premisses, 'if x is true, y is true,' and 'if y is true, z is true.' These are written

$$(x - f) (v - y) = 0$$
  
 $(y - f) (v - z) = 0$ 

Multiply the first by (v - z) and the second by (x - f) and add. We get

$$(x - f) (v - f) (v - z) = 0$$

or dividing by v - f, which cannot be 0,

$$(x - f)(v - z) = 0;$$

and this states the syllogistic conclusion, 'if x is true, z is true'' (3.367). If we operate on a simple variable, we shall need but one operation, "for there are but two things that can be said about a single proposition, by itself; that it is true and that it is false,

$$x = v$$
 and  $x = f'' (3.369)$ .

The Philonian function. Peirce had always insisted on reducing logical operations to a minimum by virtue of the principle of parsimony.<sup>30</sup> As he recalled in 1896, he had already proposed the Philonian implication, as far back as 1867, as the sole function which he called illation and which the modern logicians together with Russell called material implication. "I have maintained since 1867 that there is but one primary and fundamental logical relation, that of illation, expressed by *ergo*. A proposition, for me, is but an argumentation divested of the assertoriness of its premiss and conclusion.

This makes every proposition a conditional proposition at bottom" (3.440). We saw how in 1880 he passed from the inclusion of terms to the implication of propositions. The definition he gave in 1885 is identical to Philo's and to the one Frege was in the process of discovering. Whether the proposition is hypothetical or conditional

 $A \rightarrow B$ 

where A and B represent simple propositions, this hypothetical proposition "may therefore be falsified by a single state of things, but only by one in which A is true while B is false" (3.374).

The system of axioms. Peirce then constructs a system of axioms which he calls icons, with the sole functor of implication. Let us remember that Frege, Russel, and Whitehead use two functions: The implicator and the negator. The function of negation confers an undeniable technical superiority on their systems with respect to Peirce's, though he does not ignore it, for he introduced it under the form of the constant "false" in 1880 and 1885. As Peirce was well aware as early as 1867 axioms or icons are tautologies (3.41). His own system contains five axioms.

(1) 
$$x - < x$$
.

This axiom "does not of itself justify any transformation, any inference. It only justifies our continuing to hold what we have held" (3.375). In 1958 the English logician A.N. Prior showed that this axiom was superfluous.

(2) 
$$\{x \rightarrow (y \rightarrow z) \rightarrow (y \rightarrow (x \rightarrow z) (3.377))$$
.

This is the law of commutation.

$$(3) (x \longrightarrow y) \longrightarrow \{(y \longrightarrow z) \longrightarrow (x \longrightarrow z)\}.$$

This is the law of the transitiveness of implication or principle of the syllogism (3.379).

(4) Peirce does not express the fourth axiom symbolically. He writes: "We have already seen that if a is true, we can write x - a, whatever x may be. Let b be such that we can write b - x whatever x may be. Then b is false. We have here a *fourth icon*" (3.381). He could have formulated it in the following way:

$$f \longrightarrow x.$$
(5) {(x \longrightarrow y) \longrightarrow x} \longrightarrow x (3.384).

This axiom is known in logic as Peirce's law.

It will be noted that in this system the negation of a proposition is

defined by the fourth axiom as the implication of any proposition whatever and of the false:

$$x \longrightarrow f$$
.

# 5. Discovery of Greek cosmology

It is thanks in part to his teaching of logic at Johns Hopkins University that Peirce was able to elaborate his system of symbolic logic, urged on by such brilliant students as Oscar Mitchell and Christine Ladd. They were not the only ones to attend Peirce's courses in logic or to listen to his lectures at the Metaphysical Club of the University. At the time Johns Hopkins counted among its students people who were soon to become famous in the history of American thought: Josiah Royce and John Dewey in philosophy, Thorstein Veblen in economy, Joseph Jastrow and Lester Ward in psychology. Another two less famous students were to play an important role in the evolution of Peirce's thought: Alan Marguand and Benjamin Eli Smith.<sup>31</sup> They were to oblige Peirce to read the Greek philosophers, including Aristotle, of whose writings he was only familiar with those on logic and metaphysics. Moreover he had read them too early to be able to draw much profit from them.<sup>32</sup> The history of Peirce's thought is a return to the origins: From English Empiricism he passed to the Middle Ages from which he learnt classical logic and through Duns Scotus he became familiar with the reality of universals; from the Middle Ages he then turned to Greek Antiquity and all the more eagerly as he was on the verge of finding the solution to all his cosmological problems as well as the reply to unformulated questions concerning the nature of categories, signs and science.

Peirce initially discovered the logic and the physics of the Epicureans while directing a work by Alan Marquand on "The logic of the Epicureans" which involved the translation of a manuscript by Philodemus found at Herculaneum and which had as its subject signs and inferences from signs: *Peri* sèmeiôn kai sèmeiôseôn.<sup>33</sup> It is from Philodemus that Peirce takes his idea of a science of signs, semiotic, and the name of inference through signs: *Semiosis*. Epicurus and his *clinamen* were to show him the way to a world where chance is first and foremost, something that Darwinism, in the interpretation given to it by Peirce, confirmed.

Benjamin E. Smith's influence was indirect but preponderant in the sense that on leaving Johns Hopkins, Smith became the director of the Cen-

*tury Dictionary* and asked Peirce to take charge of all the articles relative to logic and philosophy, to mathematics, to mechanics and astronomy, to weights and measures and to the idea of what a university is — all subjects which a careful scholar could not fail to see interested Peirce greatly. A conscientious worker, Peirce began his syllabus with a course on philosophical terminology and with a reading of Aristotle in the edition by Berlin which was to be of use to him as a reference text. But Aristotle's *Physics* did not immediately yield all its cosmological secrets. If in 1884, shortly after leaving Johns Hopkins, Peirce discovered another conception of chance in it, he had not yet read in it the idea of continuity which he was later to make his own.<sup>34</sup>

Would he have discovered it sooner had he continued to teach, or was indeed a knowledge of Cantor indispensable for him to open his eyes?

However that may be, the 26<sup>th</sup> of January 1884 marked the end of the cosmopolitan period. Peirce's contract was abruptly put to an end without an official justification. He had taught at Johns Hopkins from 1879. Another era was about to begin, in poverty and in the light cast by Greek thought.

# **Chapter Three**

# The Sun Set Free (1887-1914)

# 1. Arisbe

Peirce had considered the possibility of settling down in Baltimore. Just as he was leaving Johns Hopkins, the Coast and Geodetic Survey, for which he continued working until 1891, stopped its field work, leaving Peirce free to pursue his work at home. He then began searching for a permanent residence so as to be free to devote himself to his work. In 1887 a small inheritance enabled him to buy and enlarge a farmhouse in Milford, Pennsylvania where he was to live with his wife until his death. He called it Arisbe as a tribute to Homer and in remembrance of his voyage to Greece in 1870 where he had relived in his mind the adventures of Asios of Arisbe while passing through the Straits of the Dardanelles, and even more so, says Max Fisch, as a tribute to the first philosophers of Greece, who first had sought "the *Archê*, the Principle, the First of things."<sup>35</sup>

Arisbe places Peirce's work in the cosmological line of the great Greek philosophers whom he had just discovered and with whom he continued living from then onwards: Thales and Pythagoras, Aristotle and Plato, Epicurus and Philodemus.

In this new perspective Peirce reconsidered the conclusions of his previous research, reworked them in greater detail and systematized them but he never managed to write the philosophical *summa* that he had set himself the task of accomplishing. The serious need of money incessantly obliged him to accept any kind of paid work, merely survive: commissioned articles for reviews and dictionaries, reviews of philosophical and scientific works, which distracted him from the goal he had set himself. In 1890, Peirce first envisaged the possibility of solving the enigma of the universe ("The Solution of the Enigma") and of erecting "a philosophical edifice

that shall outlast the vicissitudes of time" (1.1). But, with his work only just begun a series of articles was requested of him for the Monist (1891-1983) which, if they put an end to the realization of his project, none the less gave him the opportunity of dealing with a few cosmological problems. In 1893 he attempted to publish his 1867-1868 and 1877-1878 articles revised and corrected (which we have already analysed), in a volume entitled Search for a Method. As he did not find a publisher, he started a subscription for a treatise in twelve volumes entitled The Principles of Philosophy. As he found no subscribers, he transformed volumes 11 and 111 in a Grand Logic which was no more successful. And he never completed his Minute Logic which he began writing in 1902. All things considered, apart from a few articles relating to mathematical logic and to religion, Peirce ended up expressing himself best in his commissioned works: the 1892-1893 Lowell Lectures, the 1898 Cambridge Lectures on "reasoning and the logic of things," his 1901 and 1902 contributions to Baldwin's Dictionary of Philosophy and Psychology, his lectures and articles of 1903 to 1907 that were taken up again as the result of the current wave of pragmatism. Therefore, at his death Peirce left a massive quantity of manuscripts of which only a part was brought to light between 1931 and 1935 and in 1958 as the Collected Papers. During his lifetime, only a few close friends such as William James were able to appreciate fully the breadth, depth and greatness of Peirce's work.

# 2. The system

Interesting as the scrupulously chronological reconstruction of Peirce's development during the current period may be for the researcher, the circumstances of this development do not help clarify it. Many of the unpublished papers are more the expression of the experience of thinking than the full statement of a finished thought system, while the published papers are numerous. On the other hand, Peirce's opportunities to express himself were so rare that he seemed to have used a good number of his articles as a kind of "hold-all" in which he included all that he wanted to say and sometimes without much consideration for the subject in question. For this reason we believe it preferable to analyse the last phase of Peirce's work by following the articulations of his system while respecting as far as possible the chronological order of such articulations.

In the manner of the nineteenth century and of Comte in particular, Peirce proposed a classification of sciences, in 1902 and 1903, of which we will here give the outlines. There are three types of sciences: the science of discovery, the science of the review of results (this is what Humboldt, Comte and Spencer concerned themselves with, says Peirce), and practical science. The science of discovery includes mathematics, philosophy and idioscopy or science of observation which is subdivided into physical sciences and human sciences (1.181-189). Philosophy entails two sub-classes: necessary philosophy that "might be called *epistêmy*, since this alone among the sciences realizes the Platonic and generally Hellenic conception of  $\epsilon\pi\iota\sigma\tau\eta\mu\eta$ " (1.279), and theôrics which is divided into *chronotheôry* and *topotheôry*, but, says Peirce: "This kind of study is in its first infancy" (1.278).

There are three orders of necessary philosophy. Phenomenology, which is the doctrine of categories; the normative sciences, esthetics, ethics, logic; and metaphysics, general or ontological metaphysics, religious metaphysics which is concerned with God, freedom, and immortality, and physical metaphysics or cosmology "which discusses the real nature of time, space, laws of nature, matter, etc." (1.192; cf. 1.190-192 and 1.280-282).

Thus the truly philosophical sciences are, according to their order of dependance: phenomenology, the normative sciences and metaphysics. This is the order we will follow in the present section. Phenomenology does not however come before all else: it depends on pure mathematics. As we have seen, pure mathematics is not of an inductive nature. It is deductive in two senses: by its method it draws "necessary conclusions" and by its aims and subject matter it studies the "hypothetical states of things" (4.238), under the form of "pure hypotheses" without ever requiring to know "what the actual facts are" (3.560). This is where mathematics differs from logic: It is "purely hypothetical: It produces nothing but conditional propositions," whereas logic, on the contrary, "is categorical in its assertions" (4.240). Mathematics, therefore, does not depend "in any way upon logic" and indeed "all formal logic is merely mathematics applied to logic" (4.228). It no more depends upon logic than do ethics (4.242) or phenomenology (8.297). What is more, logic depends on phenomenology (8.297) and ethics (8.158). And metaphysics is grounded in "scientific logic" (8.158): "Metaphysics consists in the results of the absolute acceptance of logical principles not merely as regulatively valid, but as truths of being" (1.486). Whence the Peircean

hierarchy of the philosophical sciences whose starting point is mathematics: phenomenology, ethics, logic and metaphysics.

It will have been observed that Peirce has a particular liking for neologisms. In truth it is not a matter of taste, but of the desire for clarity and in the name of what he calls, as we have said, the morals or ethics of terminology (2.219-226). All confusions derive from the fact that we give words meanings that they do not have. The remedy is simple: to each new idea there should correspond a new word and this new word must be used in the sense given to it by its inventor. If its sense is modified one is under the moral obligation of using another word. Consequently Peirce substituted phenomenology with "phaneroscopy", pragmatism with "pragmaticism", and he coined new words for the numerous ideas he proposed, especially in relation to the new science of signs calls "semiotic."

# 3. Phenomenology<sup>36</sup>

Peirce had hardly drawn up his new list of categories in 1867 when he abandoned it, for it no longer fitted in with his new conception of logic as imposed by the logic of relations. Such abandonment may seem surprising if it is true that phenomenology is independent of logic. But, beyond the fact that Peirce did not exclude that phenomenology could appeal to deductive logic (8.297), phenomenology depends on mathematics which demonstrates that it is impossible to form a genuine three by any modification of the pair (1.363) and that, consequently, phenomenology like logic, of which it is the foundation, can only be triadic — which was not the case in Aristotle's logic which is dyadic.

Moreover, the critique of Cartesianism forbade all recourse to sensorial impressions; this emptied the first category of the quality of all contents, whilst its task was to unify the different sensorial impressions. And the new theory of knowledge which derived from this required that a new content be given to secondness, no longer a simple passive "relation," and to thirdness, no longer a static "representation."

The new list of categories had been ready as far back as 1875, but Peirce waited ten years before supplying it with a logico-mathematical justification and a cosmological content. The 1875 text deserves to be reproduced *in extenso*, if only so that we may compare it with the 1867 list. "By the third, I mean the medium or connecting bond between the absolute first and last. The beginning is first, the end second, the middle third. The end is second, the means third. The thread of life is a third; the fate that snips it, its second. A fork in a road is a third, it supposes three ways; a straight road, considered merely as a connection between two places is second, but so far as it implies passing through intermediate places it is third. Position is first, velocity or the relation of two successive positions second, acceleration or the relation of three successive positions third. But velocity in so far as it is continuous also involves a third. Continuity represents Thirdness almost to perfection. Every process comes under that head. Moderation is a kind of Thirdness. The positive degree of an adjective is first, the superlative second, the comparative third. All exaggerated language, "supreme," "utter," "matchless," "root and branch," is the furniture of minds which think of seconds and forget thirds. Action is second, but conduct is third. Law as an active force is second, but order and legislation are third. Sympathy, flesh and blood, that by which I feel my neighbour's feelings, is third" (1.337). Position replaces quality; action, the relation; continuity, the representation. It will be noted that in his 1878 paper "How to Make Our Ideas Clear," Peirce does not radically set action and relation in opposition to each other: "When I just said that thought is an action, and that it consists in a relation, although a person performs an action but not a relation, which can only be the result of an action, yet there was no inconsistency in what I said, but only a grammatical vagueness" (5.399).

Peirce expounded his new theory of categories for the first time in his 1885 article "On the Algebra of Logic" (3.359-363). He developed it from the moment of his settling in Arisbe in an unpublished paper: "The Solution to the Enigma," of 1890 (1.354-368, 373-375, 379-416). He presented it in the first article in the same way as he had presented his first list, in the context of a theory of signs. Peirce begins by distinguishing the triadic relation which alone is genuine from the other relations which are "degenerate," "just as two lines are called a degenerate conic" (3.359). Peirce here calls the genuine relation of a sign a *token* (the term he more generally uses is symbol). It is "a conjoint relation to the thing denoted and to the mind." The relation to its object is the consequence of "a mental association, and depends upon a habit." It is "always abstract and general" and "for the most part, conventional or arbitrary." All forms of speech are triadic relations of this kind (3.360).

When the triadic relation between the sign, its object, and the mind, is degenerate, then of the three pairs (sign-object, sign-mind, object-mind),

two at least are in dual relations which constitute the triadic relation. But if there is "a direct dual relation of the sign to its object independent of the mind using the sign," then this relation is a genuine second relation. "Of this nature are all natural signs and physical symptoms." Peirce calls such signs indices, "a pointing finger being the type of the class." "The index asserts nothing; it only says 'There!' It takes hold of our eyes, as it were, and forcibly directs them to a particular object, and there it stops. Demonstrative and relative pronouns are nearly pure indices, because they denote things without describing them; so are the letters on a geometrical diagram (...)" (3.361).

The first monadic relation is where "the dual relation between the sign and its object is degenerate," because it "consists in a mere resemblance between them." This is an *icon*. A diagram taken in itself independently of its signification, a painting contemplated at a moment when we no longer distinguish consciously between the real thing and its representation are examples of icons (3.362).

The three phaneroscopic or phenomenological categories thus correspond to the three types of relations described by the logic of relatives: "The first is that whose being is simply in itself, not referring to anything nor lying behind anything. The second is that which is what it is by force of something to which it is second. The third is that which is what it is owing to things between which it mediates and which it brings into relation to each other" (1.356).

Peirce expressly connects his list to the logic of relatives in his 1885 article when, regarding the index, he says that he owes the concept of index to "the introduction of indices into the algebra of logic" under the form we have described where the relation expressed by a token or symbol, let us say F, has the generality of thirdness, but furnishes no indication concerning the terms in relation or the subjects of the relation. This is the function that Mitchell granted to the indices, let us say *i*, *j*, in the relation  $F_{ij}$ , which indicates that they are these terms or subjects, but says nothing about them (3.363). This is why secondness is the category of the individual.

In the same way Peirce links thirdness to continuity. This connection, however, is not a matter of course as is rightly observed by Murray G. Murphey who cites Peirce's unpublished text in which it is demonstrated that this assimilation is a consequence of the logic of relatives. Peirce explains in it that contrary to the grammarians, he does not limit the subject to the nominative subject alone;

... the grammarians usually limit the term [subject] to the subject nominative, while I term anything named in the assertion a Subject, and although I do not always express myself so accurately, I regard everything to which the assertion relates and to which reference can be removed from the predicate, although what is referred to be a quality, relation, state of things, etc., as a Subject. Thus one assertion may have any number of Subjects. Thus, in the assertion "Some roses are red," i.e. possess the color redness, the color redness is one of the Subjects; but I do not make "possession" a Subject, as if the assertion were "Some roses are in the relation of possession to redness," because this would not remove relation from the predicate, since the words "are in" are here equivalent to "are subjects of," that is, are related to the relation of possession of redness. For to be in relation to X, and to be in relation to a relation to X, mean the same thing. If therefore I were to put "relation" into the subject at all, I ought in consistency to put it in infinitely many times, and indeed, this would not be sufficient. It is like a continuous line: No matter what one cuts off from it a line remains. So I do not attempt to regard "A is B" as meaning "A is identical with something that is B." I call "is in the relation to" and "is identical with" Continuous Relations, and I leave such [relations] in the predicate.

Murphey sees in this the source of the two main principles of Peirce's synechism: The relations constitute continual connections between correlates and every creation of new relations is a determination of existing relations.<sup>37</sup>

A brief comparison with the 1867 theory of categories will enable us to appreciate the ground covered. All the 1867 categories served a mediating function between being and substance; in 1885 only thirdness was characterized by mediation and what is more it was no longer a question of mediation between being and substance. The role accorded to quality in 1867 was that of unifying that which was different in the "manifold of sensuous impressions" (1.545) with the result that the first category was the most abstract; all the categories must be involved in the unifying of the phenomena or phanerons in the new theory, and by "phenomena" not only sensorial impressions are intended; this is the reason why Peirce prefers the word "phaneron" which is "what is before the mind or in consciousness, as it appears" (8.303), and which enters one or the other of the three categories of phaneroscopy or phenomenology. Firstness which is the category of quality or of the sentiment, secondness which is the category of the individual, of haecceitas or this-ness and, consequently, of existence which establishes itself by virtue of its oppositions, of action and reaction, of effort and resistance, thirdness which is the category of mediation, of thought. In the 1867 theory, we pass from quality to relations and from

relations to representation. The symbol was expressly defined as a general sign. In the new theory the categories delimit heterogeneous fields and their hierarchy obeys an ascending principle: as it is a triadic relation thirdness presupposes a second and a first, as it is a dyadic relation secondness presupposes a first, and as it is a monadic relation firstness presupposes reflexively only itself.

All this is obvious in the first description of the categories of 1890 (1.356-362). The different role accorded to firstness is particularly outstanding: "The idea of the absolutely first must be entirely separated from all conception of or reference to anything else; for what involves a second is itself a second to that second. The first must therefore be present and immediate (...). It must be fresh and new, for if old it is second to its former state. It must be initiative, original, spontaneous, and free; otherwise it is second to a determining cause. It is also something vivid and conscious; so only it avoids being the object of some sensation. It precedes all synthesis and all differentiation; it has no unity and no parts. It cannot be articulately thought: assert it, and it has already lost its characteristic innocence; for assertion always implies a denial of something else" (1.357).

These are categories that we will now find and examine in the other philosophical sciences at the other two categorial levels. While "phenomenology treats of the universal Qualities of Phenomena in their immediate phenomenal character, in themselves as phenomena," "in their Firstness" (5.122), the normative sciences treat of "the laws of the relation of phenomena to ends," "in their Secondness" (5.123), and metaphysics "treats of Phenomena in their Thirdness" (5.124).

# 4. The normative sciences

The normative sciences are distinguished by the phenomenological or phaneroscopic nature of their relation to the ends they serve: First, esthetics relates to feeling; second, ethics relates to action; third, logic relates to thought (1.574).

*Esthetics and ethics.* Peirce is a logician. His interest in esthetics was not very great and came very late in life, dictated uniquely by the logic of his system. Schiller's *Lettres sur l'esthétique*, which he read when he was sixteen, do not seem to have made a great impression on him. Indeed he found it rather hard to admit that esthetics may be a normative science. For

that which rightly renders logic and ethics normative is "that nothing can be either logically true or morally good without a purpose to be so." Given that "a thing is beautiful or ugly quite irrespective of any purpose to be so," "it would seem, therefore, that esthetics is no more essentially normative than any nomological science" (1.575). Even when in 1902 he included esthetics among the normative sciences, Peirce continued to view the esthetics of "taste," which the Germans contributed to spreading, with skepticism, for, as he writes in 1906, "the theory is the same, whether it be a question of forming a taste in bonnets or of a preference between electrocution and decapitation, or between supporting one's family by agriculture or by highway robbery" (1.574).

Peirce came to morality earlier. He had read at least Aristotle's Nicomachean Ethics and his Politics in 1883 when made responsible for the articles connected with morality for the Century Dictionary. It was about this time, he says, that he began to be impressed by the importance of the theory of morals. Nevertheless he really took the theory of morals seriously only when he found the phenomenological key to his system in 1896. Until 1883, in any case, he doubted that morality "could be anything else but a practical science" (1.298). Now Peirce did not concern himself more with practical morality than with esthetics. In this field he was content to listen to the voice of his conscience and to follow custom - a wise conduct which the moral treatises by Jouffroy, Kant and the Utilitarians did not seem to question. Moreover Peirce declared that in morality he was a "conservatist." In 1898 he writes, "the regnant system of sexual rules is an instinctive or sentimental induction summarizing the experience of all our race. That it is abstractly and absolutely infallible we do not pretend; but that it is practically infallible for the individual — which is the only clear sense the word 'infallibility' will bear — in that he ought to obey it and not his individual reason, that we do maintain" (1.633). "To be a moral man is to obey the traditional maxims of your community without hesitation or discussion." Therefore "it needs no reasoning to perceive that morality is conservatism" (1.666). And this explains the fact that we could search the whole of Peirce's work in vain for a definite position regarding the events occurring in America, there is only just a mention of the Civil War.<sup>38</sup> Peirce is above all a logician and a theorizer.

The fundamental reason for the subordination of morality to logic comes from Peirce's new theory of knowledge. If the starting point in philosophy is no longer sensation nor methodological doubt, it being

excluded completely that anything whatsoever may be founded upon skepticism, philosophy cannot but rest upon belief. This is the sense in which we must understand the pragmatic maxim of 1878. Peirce insists upon it in 1903: "Pragmatism is the principle that every theoretical judgement expressible in a sentence in the indicative mood is a confused form of thought whose only meaning, if it has any, lies in its tendency to enforce a corresponding practical maxim expressible as a conditional sentence having its apodosis in the imperative mood" (5.18). Consequently, "if, as pragmatism teaches us, what we think is to be interpreted in terms of what we are prepared to do, then surely *logic*, or the doctrine of what we ought to think, must be an application of the doctrine of what we deliberately choose to do, which is Ethics" (5.35).

What then is the object of ethics? A normative science, ethics is the science of ends and more exactly of the ends of action which we are prepared to adopt deliberately. Analysed in phenomenological terms, the ends proposed by moralists are of three kinds: "The end purely subjective, a feeling of pleasure" of the hedonists; "the end purely objective and material, the multiplication of the race" of those who, like Karl Pearson, consider social stability as the ultimate good, and "the end" to which has been attributed "the same kind of being that a law of nature has, making it lie in the rationalization of the universe" (1.590), which is the end of the Stoics, of Kant, and of Peirce himself (5.3).

Which end should we ultimately choose? In no case the first one, for a moral man "is the man who controls his passions, and makes them conform to such ends as he is prepared deliberately to adopt as *ultimate*. If it were in the nature of a man to be perfectly satisfied to make his personal comfort his ultimate aim, no more blame would attach to him for doing so than attaches to a hog for behaving in the same way" (5.130). The second end is consonant with the social nature of man. But, in Karl Pearson's mind, the society in question is British society. "I am willing to grant - says Peirce that England has been for two or three centuries a most precious factor of human development," but to demand that man should aim as an ultimate end at "British society" or "society at large" (the kind of society being of no consequence), or "the perpetuation of the race," is to demand too much (8.141). All the more so, adds Peirce — and this is a remark which we often find in his writing, but nowhere with such a note of contempt for humanity - as "the human species will be extirpated sometime; and when the time comes the universe will, no doubt, be well rid of it" (8.141). For man is but an epiphenomenon in the evolution of the universe. This is why the ultimate end, the ultimate good resides in the evolutionary process, not in separate individual reactions, even if rational, but in reason which within evolution itself transcends its individual expressions in something general or continuous. The ultimate end is of course reason, but "the Reason that actually governs the events:" "The very being of the General, of Reason, consists in its governing individual events. So, then, the essence of Reason is such that its being never can have been completely perfected" (1.615). This is the moral aspect of synechism that "is founded on the notion that the coalescence, the becoming continuous, the becoming governed by laws, the becoming instinct with general ideas, are but phases of one and the same process of the growth of reasonableness" (5.4).

This ultimate end is the *summum bonum* (5.433) that Herbert Schneider calls fourthness.<sup>39</sup> Peirce however does not make a fourth category of it. The ultimate end of morality, the *summum bonum* is the object proper of esthetics. Or at least "Ethics, or the science of right and wrong, must appeal to Esthetics for aid in determining the *summum bonum*" (1.191), for, given that it is an "*admirable ideal*," it has the only kind of goodness that such an ideal *can* have: Namely, esthetic goodness (5.130).

Therefore the object of esthetics is not beauty. As a normative science, its object is good and evil as it is for logic and morality, "*Logic* in regard to representations of truth, *Ethics* in regard to efforts of will, and *Esthetics* in objects considered simply in their presentation" (5.36). Just as the third logic must ask the second ethics what the ultimate end of action is, so ethics must ask esthetics what "the only satisfactory aim" is. Consequently it is for esthetics to say "what is the state of things which is most admirable in itself regardless of any ulterior reason" (1.611). The "morally good" appears as "a particular species of the esthetically good" (5.130).

"But the instant that an esthetic ideal is proposed as an ultimate end of action, at that instant a categorical imperative pronounces for or against it." Can this categorical imperative escape all control? Any aim whatever, replies Peirce, which can be unfalteringly adopted and consistently pursued exercises control over him. It is truly an ultimate aim (5.133).

Furthermore, it should be "immutable under all circumstances." This is possible under two conditions which are related to the esthetic nature of the determination of the *summum bonum*. Firstly, for it to be an ultimate aim, it should accord with "a free development of the agent's own esthetic quality," and secondly, it should not ultimately tend to be disturbed by "the

reactions upon the agent of that outward world which is supposed in the very idea of action," reactions which the agent cannot fail to experience. "It is plain that these two conditions can be fulfilled at once only if it happens that the esthetic quality toward which the agent's free development tends and that of the ultimate action of experience upon him are parts of one esthetic total" (5.136) evolving in the cosmic process of the rationalization of the universe.

Logic. "When our logic shall have paid its devoirs to esthetics and to ethics, it will be time for it — says Peirce — to settle down to its regular business" (2.200). Logic is the science of how we must think in order that we think that which is *true*. It studies, therefore, "the reference of symbols in general to their objects" (1.559). Its domain is thirdness. But depending on whether we are examining symbols in their relation to a ground, object or interpretant, logic is subdivided, as we said in the general presentation, into speculative grammar as first, critic or epistemology as second, speculative rhetoric or methodeutic as third.

Semiotic. Speculative grammar is the theory of signs or semiotic: Signs are studied in themselves as symbols. From his very first writings, Peirce's sign theory was connected with formal logic and phenomenology and he followed their development in 1867 and 1885, but he never attempted to make it a separate science until his encounter with Philodemus. Semiotic is the product of the conjunction of Philodemus' *sémiôsis* and the triadic logic of relations. Semiosis is the triadic action of a sign which involves "a cooperation of *three* subjects, such as a sign, its object, and its interpretant, this tri-relative influence not being in any way resolvable into actions between pairs" (5.484). The sign is therefore divided into firstness, secondness and thirdness in relation respectively to its ground, object and interpretant in three trichotomies of signs, as illustrated in the following Table (cf. 2.243-252).

	Firstness	Secondness	Thirdness	
Representamen	Qualisign	Sinsign	Legisign	
Object	Icon	Index	Symbol	
Interpretant	Rheme	Dicisign	Argument	

#### THE SUN SET FREE

This gives 3<sup>3</sup>, twenty-seven classes of possible signs of which only ten respect the principle of the hierarchy of categories which stipulates that a third presupposes a second and a first, a second presupposes a first, a first nothing other than itself. These are the ten classes of signs described by Peirce in 1903 (2.254-263). They became 28 in 1908 when Peirce distinguished six trichotomies in the place of three by subdividing the object, the second, into the immediate object and the dynamical object and the interpretant, the third, into the immediate, dynamical and final interpretants, while the representamen, the first, is not subdivided. The number of classes of signs would be 66 if, as Peirce believed, there were ten possible trichotomies and not six or three.

In the table of three trichotomies, only the trichotomy of the representamen is really new: it analyses the sign as such depending on whether it is a first, a second or a third. First — a qualisign or sign which is a quality independently of the fact that it is embodied in a concrete individual object: The colour red, even if a red object does not exist. The qualisign is a sensible in the Aristotelian sense: It is possible, but real. Second - sinsign or sign embodied in an object: The redness of this hat here. Third — a legisign or law which is most often a sign of the conventional type: All these words I am writing; not, however, in so far as they are graphic marks, for in that case the legisign would not be general, but rather in so far as the legisign is a rule of signification; the graphic expression of a legisign is a concrete individual replica which is a sort of sinsign (2.244-246). In relation to the object that it designates, the sign may be an icon, index or symbol. An icon is "a Representamen whose Representative Quality is a Firstness of it as a First" (2.276), an index is "a Representamen whose Representative character consists in its being an individual second" (2.283), a symbol is "a Representamen whose Representative character consists precisely in its being a rule that will determine its Interpretant" (2.292). "A sign is either an icon, an index, or a symbol. An icon is a sign which would possess the character which renders it significant, even though its object had no existence; such as a lead-pencil streak as representing a geometrical line. An *index* is a sign which would, at once, lose the character which makes it a sign if its object were removed, but would not lose that character if there were no interpretant. Such, for instance, is a piece of mould with a bullet-hole in it as a sign of a shot; for without the shot there would have been no hole; but there is a hole there, whether anybody has the sense to attribute it to a shot or not. A symbol is a sign which would lose the character which renders it a sign if

there were no interpretant. Such is any utterance of speech which signifies what it does only by virtue of its being understood to have that signification" (2.304). Icons and indices assert nothing: The icon is conjugated in some way in the subjunctive, the index in the imperative. The symbol alone asserts: It is conjugated in the indicative or better still in the declarative (2.291). In relation to its interpretant, the sign is a rheme, a dicisign or argument. This trichotomy corresponds to the classical logical trichotomy of the term, proposition and syllogistic reasoning, though transformed by the new logic as it is derived from the logic of relatives. The transformation affects the whole trichotomy: the argument is a hypothetical proposition of the type "if...then...," the proposition is "inclusive" and the rheme is a propositional function.

Semiotic at this third level is inseparable from the new formal logic and its developments during the last period of Peirce's life. To begin with, the rheme is a propositional function. If we replace the relative terms with dashes in a proposition represented graphically, we obtain rhemes. The dashes, as in chemistry, mark the valencies of the logical radical. Thus " loves —" is a dyadic rheme; "— gives — to —," a triadic rheme, etc. A rheme may have but one valency and be monadic: " — is mortal;" " — is a man." In this case, the rheme is called non-relative and the joining of two rhemes of this type, produces, as in chemistry, a saturated compound: A complete proposition. In fact, if we join " — is mortal" and " — is a man," we have "X is mortal and X is a man," or "some man is mortal" (3.420-421).

Formal Logic. The conception of the rheme as a propositional function dates back to 1892. Other logical innovations were to follow like links in a chain, as it were, for they all derive from Peirce's idea of representing logical relations graphically, as is the practice in chemistry. Formal implication, which emerged as early as 1880 (cf. 3.175), is made explicit in 1896. We must not confuse formal implication with material or Philonian implication as expressed in the relation "if... then ...," whose discovery Peirce traces back to 1867. Formal implication appears as follows. "Now let us express the categorical proposition, 'Every man is wise.' Here, we let  $m_i$  mean that the individual object *i* is a man, and  $w_i$  mean that the individual object *i* is wise. Then, we assert that, 'taking any individual of the universe, *i*, no matter what, either that object, *i*, is not a man or that object, *i*, is wise" (3.445). In 1902, but we find verbal equivalents as early as 1885<sup>40</sup>, Peirce constructed truth tables (4.261-262), as we do today, by taking into account

all the possible truth values of a proposition according to the number of propositions:

x	У
v	v
v	f
f	v
f	f

Similarly in 1902, taking up an idea of 1880,<sup>41</sup> Peirce invented that which was to become Sheffer's function from the name of its "reinventor" in 1921 (4.264-265). And in 1909, he described a trivalent logic, truth tables included, more than ten years before Lukasiewicz.<sup>42</sup> But the great discovery he was always to pride himself on, calling it "my chef d'œuvre," is the logic of existential graphs. This is an original systematization of Peirce's contribution to modern logic. Peirce worked on it constantly from 1889 up until his death. We can give only a very approximative idea of it here.<sup>43</sup> Let us say that it pushes the graphic translation of logical relations to the extreme. The system described is that of logic made of two functions: The negator and the relative because they are functions which are graphically expressible with the maximum economy.<sup>44</sup> Proposition A written down on a piece of paper or on a blackboard is asserted; surrounded by a close, it is negated. A double close is equivalent to an assertion. The conjunction is expressed through a simple juxtaposition within the same drawing. Thus, "It is false that A" will be written as follows:



and "It is true that A and B: AB. The implication "If it is true that A, then B," will be written as follows:



In fact, the graph says that the relative of the assertion of A and the negation of B is false, in other words, if we set A, it is impossible that non B, therefore B. We would write this in modern symbolic logic, using Russell's symbols, as follows:

$$\sim (A. \sim B) \equiv (A \supset B).$$

The disjunction of A and B will be expressed just as easily with



which reads: The conjunction of the negation of A and of the negation of B is false, which is the very rule of alternative disjunction which can only be false when the two propositions of the disjunction are false. We would write this, today, as follows:

$$\sim (\sim A. \sim B) \equiv (A \lor B).$$

Abduction, induction, deduction. Speculative grammar, therefore, studies signs in themselves: It is first. Critic or epistemology is second: It studies signs in their relation to the world. In accordance with the phenomenological nature of semiosis, that is of inference from signs, we may distinguish between abduction first, induction second and deduction third. Peirce usually defines these three modes of inference in relation to each other. "Abduction is the process of forming an explanatory hypothesis. It is the only logical operation which introduces any new idea; for induction does nothing but determine a value, and deduction proves that something *must* be; Induction shows that something *actually is* operative; Abduction merely suggests that something *may be*. Its only justification is that from its suggestion deduction can draw a prediction which can be tested by induction, and that, if we are ever to learn anything or to understand phenomena at all, it must be by abduction that this is to be brought about" (5.171).

Abduction, induction and deduction form three subdivisions of the simple argument. Deduction is necessary or probable. In so far as it is necessary, it "is a method of producing Dicent Symbols (cf. 2.251) by the

#### THE SUN SET FREE

study of a diagram." It is either corollarial or theorematic. In so far as it is corollarial, it draws its conclusion from the observation of a diagram. In so far as it is theorematic, it draws its conclusion from an experiment performed upon the diagram (2.267). Probable deduction is either statistical deduction or probable deduction proper. Statistical deduction represents its conclusion as certain, probable deduction proper does not (2.268).

Induction "is a method of forming Dicent Symbols concerning a definite question" (2.269). Peirce distinguishes three different varieties of induction: Crude induction, quantitative induction and qualitative induction. Crude induction is enumerative like Baconian induction, but insists upon the absence of instances to the contrary (2.756). Quantitative induction is the strongest. It asks itself "What is the 'real probability' that an individual member of a certain experimental class, say the S's, will have a certain character, say that of being P?" This it does by first collecting, on scientific principles, a fair sample of the S's and presumes that "the value of the proportion, among the S's of the sample, of those that are P, probably approximates, within a certain limit of approximation, to the value of the real probability in question" (2.758). Quantitative induction is therefore a reversed statistical deduction. Qualitative induction is synonymous with hypothesis or abduction.

Abduction "is a method of forming a general prediction without any positive assurance that it will succeed either in the special case or usually, its justification being that it is the only possible hope of regulating our future conduct rationally, and that Induction from past experience gives us strong encouragement to hope that it will be successful in the future" (2.270). Peirce had initially opposed abduction to induction. The great difference between them being that induction "infers the existence of phenomena such as we have observed in cases which are similar," while abduction "supposes something of a different kind from what we have directly observed, and frequently something which it would be impossible for us to observe directly" (2.640). As Peirce himself tells us, it was to abduction taken in this sense that he was appealing to when once, on landing at a Turkish seaport, he saw a man on horseback surrounded by four horsemen holding a canopy over his head and inferred that this man was the governor of the province. In the same way, we make use of abduction when we maintain that wherever we find fossilized fish the sea once washed over the land, or that Napoleon existed on the basis of the documents that refer to him. And Peirce concludes that abduction is "a weak kind of argument"

(2.625). This is no longer the case if instead of opposing abduction to induction, we integrate it, as Peirce does in 1902, into the new conception of inference or of renewed induction. "Induction, is an Argument which sets out from a hypothesis, resulting from a previous Abduction, and from virtual predictions, drawn by Deduction, of the results of possible experiments, and having performed the experiments, concludes that the hypothesis is true in the measure in which those predictions are verified, this conclusion, however, being held subject to probable modification to suit future experiments" (2.97).

This new theory of abduction and induction was possible owing to the fact that Peirce founded the validity of induction upon a realistic conception of probability. In a 1902 paper published in Baldwin's *Dictionary*, Peirce described three types of probable inference: Inductive or experimental inference, probable deduction and presumptive or abductive inference.

In the first we proceed by induction and infer from repeated and verified observations that "the general character of the whole endless succession of similar events in the course of experience will be approximately of the character observed." Peirce justified this form of induction as follows: "Thatendless series must have some character; and it would be absurd to say that experience has a character which is never manifested. But there is no other way in which the character of that series can manifest itself than while the endless series is still incomplete. Therefore, if the character manifested by the series up to a certain point is not that character which the entire series possesses, still, as the series goes on, it must eventually tend, however irregularly, towards becoming so; and all the rest of the reasoner's life will be a continuation of this inferential process. This inference does not depend upon any assumption that the series will be endless, or that the future will be like the past, or that nature is uniform, nor upon any material assumption whatever" (2.784).

The second kind of probable inference is necessary inference. But, applied to probability, necessary inference becomes from another point of view a probable inference. "If of an endless series of possible experiences a definite proportion will present a certain character (which is the sort of fact called an objective probability), then it necessarily follows that, foreseen or not, approximately the same proportion of any finite portion of that series will present the same character, either as it is, or when it has been sufficiently extended," objective or real probability being "the ratio in the long run of experience of the number of events which present the character of which the probability is predicated to the total number of events which fulfill certain conditions often not explicitly stated, which all the events considered fulfill" (2.785).

It is in another article written for Baldwin's Dictionary that Peirce explains why, in his opinion, mathematical reasoning is inductive. "We form in the imagination some sort of diagrammatic, that is, iconic, representation of the facts, as skeletonized as possible. The impression of the present writer is that with ordinary persons this is always a visual image, or mixed visual and muscular; (...) If visual, it will either be geometrical, that is, such that familiar spatial relations stand for the relations asserted in the premisses, or it will be algebraical, where the relations are expressed by objects which are imagined to be subject to certain rules, whether conventional or experiential. This diagram, which has been constructed to represent intuitively or semi-intuitively the same relations which are abstractly expressed in the premisses, is then observed, and a hypothesis suggests itself that there is a certain relation between some of its parts — or perhaps this hypothesis had already been suggested. In order to test this, various experiments are made upon the diagram, which is changed in various ways. This is a proceeding extremely similar to induction (...)" (2.778). (Cf. 3.363) quoted above p.37).

The third kind of probable inference is abduction which Peirce also calls presumptive inference. The whole argument comes down to this, that "the observed facts show that the truth is *similar* to the fact asserted in the conclusion." But what justifies the acceptance of that conclusion? It does not necessarily, nor "with any necessitated objective probability," follow from the premisses. The only method by which it can be proved that a method "without necessarily leading to the truth, has some tolerable chance of doing so," given that it is founded upon an objective or real probability, is the inductive method. This method alone is able to justify the validity of abductive or presumptive inference (2.786). The ultimate foundation of probable inference under its three forms is therefore the reality of probability. The way to truth and reality passes through fallibilism (5.587).

Logic would not be complete if it stopped here. We need to know what the nature of signs is and what their relation to their objects is, the latter being a necessary but not sufficient relation for we still need to ask ourselves what it is that enables them to act as interpretants (1.559). It will be up to speculative rhetoric to reply. In so far as it deals with "the law of the evolution of thought," which is "the study of the necessary conditions of the

transmission of meaning by signs from mind to mind, and from one state of mind to another" (1.444), the speculative rhetoric that Peirce most often calls methodeutic has as its object, therefore, the search for "a method for discovering methods" (2.108) that ought to be pursued "in the investigation, in the exposition, and in the application of truth" (1.191). Peirce did not develop it for its own sake, not because it is a minor branch of logic — it is, on the contrary, "the highest and most living branch of logic" (2.333) — but because it is implied throughout the whole of his theory of signs which presupposes the possibility of the discovery, communication and application of signs. Meanwhile it was important to assign it a place in the architecture of the system.

## 5. Scientific metaphysics

Speculative rhetoric leads directly to cosmology and to scientific metaphysics. Even though the term is incorrect, it is objective logic, "because that conveys the correct idea that it is like Hegel's logic" (1.444): The laws of thought are the very laws of the universe and the three phenomenological or phaneroscopic categories are ontological categories.

Metaphysics crowns the system, it is the place of contemplation of the categories at work in the three universes of firstness, secondness and thirdness. Max Fisch has informed us of all that Peirce's cosmology owes to Epicurus and to Aristotle and of how he became familiar with Epicurus through Aristotle making him a precursor of Darwin in his quest for or conquest of the reality of the three universes as against the claims of nominalism. As regards the laws of nature, says Fisch, all that which is not nominalism is, in Peirce's eyes, evolutionism "and every evolutionism must in its evolution eventually restore that rejected idea of law as a reasonableness energizing in the world (no matter through what mechanism of natural selection or otherwise) which belonged to the essentially evolutionary metaphysics of Aristotle, as well as to the scholastic modifications of it by Aquinas and Duns Scotus."45 This is the principle that was to support the whole edifice of Peirce's great work on The Principles of Philosophy and which was announced by the phaneroscopic identification of thirdness and continuity. This principle, which, as we have already said, bears a "close affinity" with Hegel's "objective logic," and which is "the entelechy and soul of the work" is "the principle of continuity." This principle which

64

"leads directly to Evolutionalism" undermines the very foundations of materialism, determinism and infallibilism.<sup>46</sup>

Peirce's metaphysics is scientific because it is not the metaphysics of a theologian, but of a practical, experimental scientist who is not intent upon using all possible means to find reasons to believe what he believes, but rather tracks down error wherever it filters in, even in his own beliefs. Thus metaphysics is scientific because of its logic which is the logic of science and consequently "indissolubly bound up" with morality (6.3).

The object of metaphysics is the study of "the most general features of reality and real objects" (6.6) which are naturally divided into three universes according to the three phaneroscopic categories.

Tychism. Peirce examines the first universe in his first two Monist articles of 1891 and 1892: "The Architecture of Theories" (6.7-34), "The Doctrine of Necessity Examined" (6.35-65), and in his "Reply to the Necessitarians" (6.588-618) which appeared in the Monist in 1893. Peirce maintains that "absolute chance is a factor of the universe" (6.201). This leads to the choice of the term tychism to designate his doctrine (6.102). In the first article, he attempts to demonstrate that the universe is inexplicable without the idea of absolute chance. If the laws of mechanics seem quite natural to us, it is because "our minds having been formed under the influence of phenomena governed by the laws of mechanics, certain conceptions entering into those laws become implanted in our minds, so that we readily guess at what those laws are." This is not true of later studies in physics which were no longer concerned with the "phenomena which have directly influenced the growth of the mind" (6.10). To account for the laws of nature we need today "to suppose them results of evolution. This supposes them not to be absolute, not to be obeyed precisely. It makes an element of indeterminacy, spontaneity, or absolute chance in nature." (6.13).

From what we have just said, we can draw a corollary, namely that the mind is an integral part of the universe; which was very soon proved by Peirce himself when he passed from physics to psychology. Psychic phenomena enter into three categories, first, the category of the feelings, second, the category of reaction sensations, third, the category of habit. Now "the one primary and fundamental law of mental action consists in a tendency to generalization" (6.21), which is no more than the tendency to contract habits. The law of habit, therefore, is a law of the universe. But, the physical laws are "absolute" and require "an exact relation," on the other hand, the mental laws, far from demanding an "exact conformity,"

reject it, for such conformity would destroy them as laws "since it would instantly crystallize thought and prevent all further formation of habit." The laws of mind "make a given feeling *more likely* to arise" (6.23).

Peirce finishes his paper by applying the triad to the universe ("Chance is First, Law is Second, the tendency to take habits is Third. Mind is First, Matter is Second, Evolution is Third," 6.32), and describes the "cosmogenic philosophy" to which these conceptions lead. This is nothing but the ancient Greek cosmology of Aristotle and Epicurus confirmed by evolutionist science. "It would suppose that in the beginning — infinitely remote — there was a chaos of unpersonalized feeling, which being without connection or regularity would properly be without existence. This feeling, sporting here and there in pure arbitrariness, would have started the germ of a generalizing tendency. Its other sportings would be evanescent, but this would have a growing virtue. Thus, the tendency to habit would be started; and from this, with the other principles of evolution, all the regularities of the universe would be evolved. At any time, however, an element of pure chance survives and will remain until the world becomes an absolutely perfect, rational, and symmetrical system, in which mind is at last crystallized in the infinitely distant future" (6.33).

In the second article Peirce wishes to show "that the principle of universal necessity cannot be defended as being a postulate of reasoning" (6.43). He sums up his four arguments in favour of the reality of chance in his "Reply to the Necessitarians" as follows: "1. The general prevalence of growth, which seems to be opposed to the conservation of energy. 2. The variety of the universe, which is a chance, and is manifestly inexplicable. 3. Law, which requires to be explained, and like everything which is to be explained must be explained by something else, that is, by non-law or real chance. 4. Feeling, for which room cannot be found if the conservation of energy is maintained" (6.613). The development of the third point deserves special attention, it completes the argument drawn from the comparison between the laws of the mind and physical laws. "Those observations which are generally adduced in favor of mechanical causation simply prove that there is an element of regularity in nature, and have no bearing whatever upon the question of whether such regularity is exact and universal or not. Nay, in regard to this *exactitude*, all observation is directly *opposed* to it; and the most that can be said is that a good deal of this observation can be explained away. Try to verify any law of nature, and you will find that the more precise your observations, the more certain they will be to show THE SUN SET FREE

irregular departures from the law. We are accustomed to ascribe these, and I do not say wrongly, to errors of observation; yet we cannot usually account for such errors in any antecedently probable way. Trace their causes back far enough and you will be forced to admit they are always due to arbitrary determination, or chance" (6.46).

Thus let it not be said that chance is a name we give to our ignorance. For this would be to presuppose an unknown cause acting with a regularity that we do not perceive, "each die moves under the influence of precise mechanical laws" (6.54). Now, "chance lies in the diversity of throws; and this diversity cannot be due to laws which are immutable" (6.55), nor can it have been established once and for all from the beginning. Therefore, Peirce thinks that "the diversification, the specification, has been continually taking place" (6.57) and that there is probably in nature "some agency by which the complexity and diversity of things can be increased" (6.58). He concludes that "by thus admitting pure spontaneity or life as a character of the universe, acting always and everywhere though restrained within narrow bounds by law, producing infinitesimal departures from law continually, and great ones with infinite frequency, I account for all the variety and diversity of the universe" (6.102).

*Synechism.* "Tychism is only a part and corollary of the general principles of 'synechism'", writes Peirce in a letter of 1897 to William James.<sup>47</sup> Synechism is the doctrine of continuity governing the universe of thirdness. Peirce expounds his doctrine in two articles of the *Monist* series articles: "The Law of Mind" (6.102-163) and "Man's Glassy Essence" (6.238-271) of 1892; in the text of a 1898 lecture on "The Logic of Continuity" (6.185-213); and in Baldwin's *Dictionary* in 1902 (6.164-168 and 169-173); and he returns to it in his papers on pragmatism especially in 1906 (6.174-176).

In the first of his 1892 articles, Peirce says that he is doing nothing more than return to his 1868 articles, correcting what there still was of "nominalistic prepossessions" (6.103). The error Peirce committed then was to consider everything which is related to what will later be called the category of feeling, as being purely sensorial and individual, in other words, as being devoid of any reality. He now declares that "when we regard ideas from a nominalistic, individualistic, sensualistic way, the simplest facts of mind become utterly meaningless. That one idea should resemble another or influence another, or that one state of mind should so much as be thought of in another, is, from that standpoint, sheer nonsense" (6.150). In short, ideas cannot be individual: They must be continual. How else would

we explain memory. "How can a past idea be present? Can it be present vicariously? To a certain extent, perhaps, but not merely so; for then the question would arise how the past idea can be related to its vicarious representation. The relation, being between ideas, can only exist in some consciousness: Now that past idea was in no consciousness but that past consciousness that alone contained it: and that did not embrace the vicarious idea" (6.107). Must we conclude that a past idea can never be present? No. for a past idea can be present "by direct perception," it must be "ipso facto present." In other words, a past idea cannot be wholly past, "it can only be going, infinitesimally past, less past than any assignable past date. We are thus brought to the conclusion that the present is connected with the past by a series of real infinitesimal steps" (6.109).<sup>48</sup> "In an infinitesimal interval we directly perceive the temporal sequence of its beginning, middle, and end - not, of course, in the way of recognition, for recognition is only of the past, but in the way of immediate feeling. Now upon this interval follows another, whose beginning is the middle of the former, and whose middle is the end of the former. Here, we have an immediate perception of the temporal sequence of its beginning, middle, and end, or say of the second, third, and fourth instants. From these two immediate perceptions, we gain a mediate, or inferential, perception of the relation of all four instants." Peirce uses the word "instant" to indicate a point in time, and "moment" an infinitesimal duration. Now, let us suppose that there be "not merely an indefinite succession, but a continuous flow of inference through a finite time, and the result will be a mediate objective consciousness of the whole time in the last moment" (6.111). The life of the mind is therefore governed by the principle of continuity: "Ideas tend to spread continuously and to affect certain others which stand to them in a peculiar relation of affectibility" (6.104).

But the phaneroscopic nature of these ideas is the same that sanctions the mathematical theory of continuity at the basis of the demonstration of the continuity of ideas. Now the theory propounded by Peirce is strongly influenced by Cantor's definition according to which continuity is a "succession of points" (6.121). Even though he sees the difficulties and in particular the contradiction in the definition of continuity in terms of discontinuous points, Peirce does not reject it. And his own Aristotelian-Kantian definition takes it for granted that the continuum is made of points. This has, as its logical consequence, the interpretation of the continuity of ideas as a mode of the connection of ideas (6.143). The threat of nominalism has

#### THE SUN SET FREE

not been completely dispelled. If the ideas are there, they must in some way be present to the mind: either actually under the form of sensorial impressions or intuitions, or virtually. But what would the nature of such virtuality be? If it is a mere possibility, what does it consist of if it is not real, a mere word?

"Is possibility a mode of being?" To this question put to him by James. Peirce was able to reply in the affirmative in 1897: "I reached this truth by studying the question of possible grades of multitude, where I found myself arrested until I could form a whole logic of possibility."<sup>50</sup> In 1896, in fact, Peirce found the means of wholly escaping nominalism by proposing a new definition of continuity which enabled him to distinguish between possibles firsts, and individual states seconds. Peirce had maintained against Cantor that continuity consisted of Kanticity and Aristotelicity: "The Kanticity is having a point between any two points. The Aristotelicity is having every point that is a limit to an infinite series of points that belong to the system" (6.166). He then realized, while studying the idea of multitude, that he had wrongly interpreted Kant whom however he had read correctly, for, in 1889, he had written that according to Kant a line "contains no points until the continuity is broken by marking the points" (6.168). "Whether the constituent individuals or units of a collection have each of them a distinct identity of its own or not, depends upon the nature of the universe of discourse. If the universe of discourse is a matter of objective and completed experience, since experience is the aggregate of mental effect which the course of life has forced upon a man, by a brute bearing down of any will to resist it, each such act of brute force is destitute of anything reasonable (and therefore of the element of generality, or continuity, for continuity and generality are the same thing), and consequently the units will be individually distinct [...]. The possible is necessarily general; and no amount of general specification can reduce a general class of possibilities to an individual case. It is only actuality, the force of existence, which bursts the fluidity of the general and produces a discrete unit [...]. Time and space are continuous because they embody conditions of possibility, and the possible is general, and continuity and generality are two names for the same absence of distinction of individuals" (4.172).

Briefly, possibles, firsts, are real: they are not words (6.152). All traces of nominalism have disappeared. They are as much part of the continuum as are individual existents, seconds, but they possess a reality that the latter do not have. They are grounded in the continuum and participate

in its nature, whilst individual existents are different from it while being part of it, such as the point at the end or at the beginning of the line: They are the unintelligible in the intelligible (3.613). Continuity, third, general and rational (1.615) is real.

It is obviously no longer possible for the last of these categories to expatiate, as did dualism, on matter and mind and on the relation between "the psychical and physical aspects of matter," for we are no longer dealing with distinct entities. "Viewing a thing from the outside, considering its relations of action and reaction with other things, it appears as matter. Viewing it from the inside, looking at its immediate character as feeling, it appears as consciousness." But these two views are combined when we remember that "mechanical laws are nothing but acquired habits, like all the regularities of mind, including the tendency to take habits, itself" (6.268). Matter therefore is not completely dead, it is merely "mind hidebound with habits" where, however, deep down there still exists "the element of diversification; and in that diversification there is life" (6.158).

The law of mind is the law itself of evolution: The principle of continuity. This is why synechism maintains that "all that exists is continuous" (1.172) and that, as we have already said in presenting it, "the coalescence, the becoming continuous, the becoming governed by laws, the becoming instinct with general ideas, are but phases of one and the same process of the growth of reasonableness" (5.4).

Agapism. The chance of tychism and the continuity of synechism are incapable on their own of accounting for evolution. They can do nothing without the power of love "the great evolutionary agency of the universe." (6.287). Love is the principle of the universe of secondness and of the Peircean doctrine of agapism. Peirce expounds his doctrine in the last article of the 1892 series: "Evolutionary Love" (6.287-317). Love can be proven no more than secondness, it manifests itself. Thus Peirce does not undertake to prove it (6.315). He quotes the Gospel according to Saint John to state that "this is the way mind develops" and as for the cosmos, "only so far as it yet is mind, and so has life, is it capable of further evolution" (6.289). Agapastic evolution is manifested at the level of thought through the way in which we may acquire a mental tendency. 1. To stray slightly from habitual ideas, without reason or constraint, is tychasm. 2. To adopt new ideas without foreseeing their consequences, but under the external constraint of circumstances or the internal constraint of the logic of ideas, is anancasm. 3. To adopt certain mental tendencies out of sympathy for an idea by virtue of

#### THE SUN SET FREE

the continuity of the mind, is agapasm. These mental tendencies may be of three varieties: The idea may affect a whole people or community; it may affect an individual directly yet without his being enabled to apprehend the idea or appreciate its attractiveness, the conversion of St. Paul may be taken as an example of this; finally, "it may affect an individual, independently of his human affections, by virtue of an attraction it exercises upon his mind, even before he has comprehended it. This is the phemonenon which has been well called the *divination* of genius; for it is due to the continuity between the man's mind and the Most High" (6.307).

God. So we pass directly from metaphysics or cosmology to religious metaphysics. We examined general metaphysics or ontology when we described the categories at work in the three universes of firstness, secondness and thirdness. Religious metaphysics deals with God, freedom and immortality. As to personal immortality, there is little to be said: it is incompatible with synechism. On the contrary, liberty finds support in tychism. Lastly, Peirce's God is no more for Peirce than for Kierkegaard the God of Churches which through their practices kill the spirit of true religion, that is, "the religion of love."<sup>50</sup> Given that man is a social being, the ideal is that "the whole world shall be united in the bond of a common love of God accomplished by each man's loving his neighbour. Without a church, the religion of love can have but a rudimentary existence" (6.443). Nor is Peirce's God the God of those theologians who strive to prove his existence. For God does not exist by virtue of an existence of secondness nor can he be proven by the reasons of thirdness. The reality of God appears of its own in the contemplation of the three universes, in the phenomenon of "divination" where God exists in the continuity of the mind. This phenomenon which Peirce described in an 1908 article entitled "A Neglected Argument in Favor of the Reality of God" (6.452-485) is in some way an exercise in firstness. Peirce calls it "musement." "Pure play," without rules or laws, besides "the law of liberty" (6.458), "musement" is the wanderings of the mind throughout the three universes. Peirce's advice to us is "Enter your skiff of Musement, push off into the lake of thought, and leave the breath of heaven to swell your sail" (6.461). It will surely lead you to the hypothesis of God's reality (6.465).

The reality of God does not constitute a separate category in Peirce's thought system. It is revealed in the evolutionary continuity of the three universes. It is therefore creative. "The process of creation has been going on for an infinite time;" and "I think — says Peirce — we must regard Crea-

tive Activity as an inseparable attribute of God" (6.506).<sup>51</sup> In any case, it is inseparable from synechism.

# Conclusion

If we are to use only one word to describe Peirce's philosophy, the following would be appropriate: Peirce's philosophy is a *synechism*. But one cannot be a "synechist" without being a "neutralist" and "fallibilist." "Neutralism" which carries us back to the Cambridge Metaphysical Club of the 1870's puts us on guard against a monistic interpretation of Peirce's antidualist and anticartesian thought. "Fallibilism" specifies how the principle of continuity at the heart of synechism is to be understood. "The principle of continuity is the idea of fallibilism objectified. For fallibilism is the doctrine that our knowledge is never absolute but always swims, as it were, in a continuum of uncertainty and of indeterminacy" (1.171).

Is synechism, in the last analysis, nothing else but Hegel's "objective logic" mentioned by us on several occasions? Peirce explains himself clearly and at length on this point. As Hegel maintains, it is true "that the whole universe and every feature of it must be regarded as rational, that is as brought about by the logic of events. But it does not follow that it is constrained to be as it is by the logic of events; for the logic of evolution and of life need not be supposed to be of that wooden kind that absolutely constrains a given conclusion. The logic may be that of the inductive or hypothetical inference." Everything in the universe cannot be "a necessary consequence of abstract being." Hegel committed here a "logical lapsus" and "the effect of this error of Hegel is that he is forced to deny the fundamental character of two elements of experience which cannot result from deductive logic" (6.218) but which are nonetheless two constitutive elements of the universe: The categories of firstness and secondness. This is where synechism is different from Hegel's "objective logic," and also because it is pragmatism, or better, pragmaticism; less "an ultimate and absolute metaphysical doctrine" than "a regulative principle of logic, prescribing what sort of hypothesis is fit to be entertained and examined" (6.173).

All things considered, synechism is a "critical philosophy of common sense" (cf. 5.505 *et sq*): It takes the world as it is, but, when there is a real doubt, it appeals to investigation and scientific inquiry.

# Notes

- 1. A chronological edition is in progress under the direction of Max H. Fisch: *Writings of Charles S. Peirce*, Bloomington, Indiana University Press. It will not include all of Peirce's writings which, in published form, would require something like 104 volumes of 600 pages each. In the meantime the researcher may have access to them thanks to the existence on microfilm of both Peirce's published and unpublished texts (see the bibliography). These may be obtained from the Widener Library of Harvard University, Cambridge, Massachusetts.
- 2. Pronounce: "p>:s".
- 3. All references are taken from the *Collected Papers*, unless otherwise indicated. Two groups of numbers are used: The first indicates the volume, the second the paragraph in that volume. Thus (8.38), the first citation, reads: Vol. 8, § 38. For the other editions of Peirce's works, see my bibliography.
- 4. For all these topics, see my works *La philosophie américaine* and Théorie et pratique du signe.
- 5. We have adopted the division proposed by Max Fisch and the interpretation he has given to it in "Peirce's Arisbe: The Greek Influence in His Later Philosophy," *Transactions of the Charles S. Peirce Society*, 1971, pp. 187-210.
- 6. Benjamin Peirce, "Linear Associative Algebra," *American Journal of Mathematics*, 1881, p. 97, cited by Murray G. Murphey, *The Development of Peirce's Philosophy*, Cambridge, Mass., Harvard University Press, 1961, p. 229.
- 7. Manuscript 958, cited by Fisch, art cit., p. 189.
- 8. Cf. Hamilton's definition of *representamen* in my article "Le representamen et l'objet dans la *semiosis* de Charles S. Peirce," *Semiotica*, 1981, pp. 195-200.
- 9. Observation by Manley Thompson, *The Pragmatic Philosophy of C.S. Peirce*, The University of Chicago Press, 1953, pp. 38-39.
- 10. The italics are mine.
- 11. François Dominique Toussaint Louverture (1744-1803), Haitian patriot who headed the revolt against the English and conquered Santo Domingo.
- 12. Manuscript 931, cited by Fisch, "Peirce's Progress from Nominalism Toward Realism," *The Monist*, 1967, p. 163.
- 13. Cited by Philip P. Wiener, Charles S. Peirce: Selected Writings, Dover, 1966, p. 11.
- 14. Peirce divides sophisms into three classes: Those which relate to continuity, those which relate to consequences of supposing things to be other than they are, and those which relate to propositions which imply their own falsity (5.333). Zeno's paradoxes, such as the

one concerning Achilles and the tortoise, belong to the first class. In Peirce's opinion, Zeno's paradoxes derive from the belief that a *continuum* has ultimate parts. "But a *continuum* is precisely that, every part of which has parts, in the same sense" (5.335). The sophisms of the second class can be resolved by distinguishing between two types of universals: Those which do not state that the subject exists and include no particular proposition and those which state that the subject exists. Thus, "If I upset my inkstand, no ink would be spilt" does not really contradict "If I upset my inkstand, the ink would be spilt," if we apply this distinction to it. In the first case, we are dealing with a material implication (in Russell's sense), in the second with an implication that takes account of reality. If there is ink in the inkstand, the implication is valid, if there is none it is not valid (5.337). The third class of sophisms consists of such paradoxes as the liar's paradox. Peirce maintains that we are not to ask ourselves whether "This proposition is not true" is a true or false proposition, for "every proposition asserts its own truth" (5.340).

- 15. Thompson, op. cit., pp. 54-55.
- 16. Cf. Emily Michael, "Peirce's Early Study of the Logic of Relations, 1865-1867," Transactions of the Charles S. Peirce Society, 1974, pp. 63-75.
- 17. On the Metaphysical Club, cf. Philip P. Wiener, *Evolution and the Founders of Pragmatism*, Harvard University Press, 1949 and Max H. Fisch, "Alexander Bain and the Genealogy of Pragmatism," *Journal of the History of Ideas*, June 1954, pp. 413-444.
- 18. E.H. Madden, ed., *The Philosophical Writings of Chauncey Wright*, The Liberal Arts Press, 1958, pp. 7.
- 19. Ibid., pp. 14.
- 20. Bain, Mental and Moral Science, cited by Fisch, art.cit., pp. 422.
- 21. Cf. Wiener, op. cit., pp. 82-83.
- 22. *Revue philosophique*, Dec. 1878, pp. 553-569; Jan. 1879, pp. 39-57. Our reference is from the *Collected Papers*, but we are using the French text of the *Revue philosophique*, save exceptions which are indicated and explained.
- 23. In the French translation of the first article, the word *inquiry* is rendered either by "recherche," or "investigation." We prefer "enquête."
- 24. In the French text, I have modified the translation at the end of the paragraph: "Une seule conclusion vraie" has been substituted for "une seule et véritable conclusion" which is a misinterpretation.
- 25. It is in these terms that Manley Thompson states what he calls "the paradox of Peirce's realism," in Wiener and Young, *Studies in the Philosophy of Charles S. Peirce*, Harvard University Press, 1952, pp. 138.
- 26. The italics are mine.
- 27. Cf. Murphey, op. cit., pp. 197.
- 28. Cf. Contributions to "The Nation," vol. 11, pp. 85 and 102 and my review: "Les grands thèmes de la philosophie de Charles S. Peirce," Semiotica 32-3/4, 1980, pp. 334-335. See chapter 3, "Deduction."
- 29. We have reproduced Peirce's notation both to show what it was like and because graphically it is more convenient. The logician will substitute it with symbols from the system of his own choice.
### NOTES

- 30. See above, 5.266, Chapter One, 3. 'Against the spirit of Cartesianism.'
- 31. On this question, cf. Max Fisch's article, "Peirce's Arisbe," which we have already cited and to which we owe the main part of this section.
- 32. Fisch, art.cit., p. 193.
- 33. Cf. Philodemus, On Methods of Inference, edited, translated and commented by Philip H. De Lacy and Estelle A. De Lacy, Naples, Bibliopolis, 1978.
- 34. Fisch, art.cit., pp. 193-194.
- 35. Fisch, art.cit., pp. 206.
- 36. We are using the terminology of the texts on the classification of the sciences.
- 37. Murphey, op. cit., pp. 317-318.
- 38. In two texts: In a draft of a letter to Lady Welby (8.357) regarding the semiotic nature of the statues erected in memory of those who fell in the War of Secession, in the Northern United States, but the allusion was not included in the letter he sent; and in an unpublished manuscript (Ms 596) which was not included in the *Collected Papers*. In the latter, in order to show that one may not be conscious of what one believes in, Peirce cites the example of the Northerners who, until the attack of Fort Sumter, did not realize "that they believed that the supremacy of the Union was to be maintained at all costs." This text was pointed out to me by Max Fisch.
- 39. Schneider, "Fourthness," in Wiener and Young, op.cit., pp. 209-214.
- 40. Cf. Pierre Thibaud, La logique de Charles S. Peirce, Les Editions de l'Université de Provence, 1975, pp. 41-44.
- 41. Cf. Ibid., pp. 46-49.
- 42. Cf. Max Fisch and Atwell Turquette, "Peirce's Triadic Logic," Transactions of the Charles S. Peirce Society, 1966, pp. 71-85.
- 43. The most important texts dealing with existential graphs are those of 1897 (3.456-552), 1903 (4.350-529), and 1906 (4.573-584). On existential graphs the following are recommended: Don D. Roberts, *Existential Graphs of Charles S. Peirce*, La Haye, Mouton, 1973 and Pierre Thibaud, *op.cit.*, pp. 161-173. Cf. Likewise the letter from Peirce to A. Robert published in my *Ecrits sur le signe*, pp. 192-199.
- 44. The logic of graphs is therefore a calculus.
- 45. Fisch, art.cit., pp. 198 and Peirce in Wiener, Charles Peirce, Selected Writings, op.cit., pp. 300.
- 46. Collected Papers, 8, pp. 283-284.
- 47. Perry, op.cit., 11, pp. 223.
- 48. The italics are mine.
- 49. Perry, op. cit., 11, pp. 223.
- 50. Cf. my Philosophie américaine, pp. 140-141.
- 51. Cf. my translation of "Un argument négligé en faveur de la réalité de Dieu," *Revue philosophique de Louvain*, August 1981, pp. 327-349.

# **Chronology\***

- 1839 10<sup>th</sup> September, birth of Charles Sanders Peirce in Cambridge, Massachusetts.
- 1855 Peirce begins reading Kant; enters Harvard.
- 1859 B.A.
- 1859-1860 Expedition to the Maine coast and in Louisiana.
- 1862 M.A.; he marries Harriet Melusina Fay.
- 1863 B.Sc. in chemistry summa cum laude.
- 1863-1865 Reading of the medieval logicians; discovery of Duns Scotus.
- 1865 Harvard Lectures: On the Logic of Science.
- 1866 Lowell Lectures: The Logic of Science; or Induction and Hypothesis.
- 1867 Peirce is elected to the American Academy of Arts and Sciences. On a New List of Categories (Proceedings of the American Academy of Arts and Sciences).
- 1868 Questions Concerning Certain Faculties Claimed for Man; Some Consequences of Four Incapacities; Grounds of Validity of the Laws of Logic: Further Consequences of Four Incapacites (The Journal of Speculative Philosophy): Critique of intuition and of Cartesianism; first theory of signs, first expression of realism.

<sup>\*</sup>Published titles are in italics. The reviews or works in which they appear are in parenthesis.

## CHARLES S. PEIRCE

1869-1870 Harvard Lectures: British Logicians.

- 1870 First voyage to Europe for the United States Geodetic Coast and Survey: 22nd December, observation of the eclipse of the sun. Description of a Notation for the Logic of Relatives, Resulting from an Application of the Conception of Boole's Calculus of Logic (Memoirs of the American Academy of Arts and Sciences).
- 1870-1887 Numerous works on astronomy and geodesy.
- 1871 Review of *The Works of George Berkeley (The North American Review)*: Paper on realism: First expression of pragmatism.
- 1871-1874 "Metaphysical Club" of Cambridge.
- 1875-1876 Second voyage to Europe; his wife leaves him.
- 1877 Elected to the National Academy of Science. Third voyage to Europe; on the ship he writes in French "Comment rendre nos idées claires" (*Revue philosophique*, 1879).
- 1877-1878 Illustrations of the Logic of Science, series including the two articles on pragmatism: The Fixation of Belief and How to Make Our Ideas Clear, and The Doctrine of Chances and The Order of Nature (The Popular Science Monthly).
- 1878 Photometric Researches, vol. 9 of the Annals of the Astronomical Observatory of Harvard College.
- 1879-1884 He teaches logic at Johns Hopkins.
- 1880 Fourth voyage to Europe. On the Algebra of Logic (American Journal of Mathematics).
- 1880-1881 Discovery of Philodemus and Epicurus.
- 1883 He marries Juliette Annette Pourtalais; fifth journey to Europe. He publishes *Studies in Logic*, which contains the works of some of his

80

## CHRONOLOGY

students including Mitchell and Marquand, an article by Peirce himself *A Theory of Probable Inference*, and a note on *The Logic of Relatives*.

1883-1884 Reading of Aristotle.

1885 On the Algebra of Mathematics: A Contribution to the Philosophy of Notation (American Journal of Mathematics): First systematic statement of his symbolic logic; first revision of the theory of categories.

1887 He retires to Milford, Pennsylvania.

- 1889-1891 He contributes to the Century Dictionary and Encyclopedia.
- 1890 A Guess at the Riddle.
- 1891-1893 The Monist series on metaphysics: The Architecture of Theories, The Doctrine of Necessity Examined, The Law of Mind, Man's Glassy Essence, Evolutionary Love, Reply to the Necessitarians: First statement of his "cosmology."
- 1892 Series on the methods of reasoning: *Pythagoras, The Critic of Arguments (The Open Court)*.
- 1892-1893 Lowell Lectures: The History of Science.
- 1893 Projects for several works: Search for a Method, The Principles of Philosophy, Grand Logic.
- 1894 The List of Categories. A Second Essay.
- 1896 Review of the Vorlesungen über die Algebra der Logik by Schroeder (*The Monist*); The Logic of Mathematics: An Attempt to Develop My Categories From Within: New revision of the categories.
- 1897 Multitude and Number: New conception of continuity. After the publication of the book by Lutoslawski on Plato's logic, reading of

the Dialogues on which he writes 200 pages (cf. Peirce's Arisbe, *art.cit.*, pp. 201).

- 1898 Cambridge lectures: Reasoning and the Logic of Things, in particular The Logic of Continuity.
- 1900 *Infinitesimals*, a letter to *Science*. He relates Aristotle's writings to the new logic of history and discovers two "errors" in the interpretation of Apellicon (cf. Fisch, *art.cit.*, pp. 202).
- 1901 Hume on Miracles and Laws of Nature.
  On the Logic of Research into Ancient History (Report of the National Academy of Sciences).
  On the Logic of Drawing History from Ancient Documents especially from Testimonies.
- 1901-1902 Contributes to the *Dictionary of Philosophy and Psychology* directed by James Mark Baldwin: Numerous papers on formal logic, semiotic, the logic of sciences (on induction in the article *Reasoning*).
- 1902 Minute Logic, a book that was never completed.
- 1903-1911 Correspondence with Lady Welby (important letters on semiotic in 1904 and 1908).
- Harvard Lectures on pragmatism.
  Lowell Lectures: Some Topics of Logic Bearing on Questions Now Vexed.
  A Syllabus of Certain Topics of Logic, published by Alfred Mudge & Son, Boston: Papers on phaneroscopy, semiotic, induction, the logic of graphs.
- 1905 Series on pragmatism (*The Monist*).
- 1908-1909 Series on the "labyrinths" (Mazes) (The Monist).

## CHRONOLOGY

- 1908 A Neglected Argument for the Reality of God (The Hibbert Journal).
- 1911 Peirce's last piece of writing: A Sketch of Logical Critic; with a text on continuity: Achilles and the tortoise.
- 1914 10th April, Peirce's death in Arisbe, Milford.

## **Bibliography**

Works by Charles S. Peirce

*Collected Papers*, Harvard University Press, I-VI published by Charles Hartshorne and Paul Weiss, 1931-1935; VII and VIII published by Arthur W. Burks, 1958.

Charles S. Peirce's Letters to Lady Welby, published by Irwin C. Lieb, New Haven, Connecticut, Whitlock's Inc., 1953.

Richard S. Robin, Annotated Catalogue of the Papers of Charles S. Peirce, The University of Massachusetts Press, 1967.

*Contributions to the Nation*, collected by Kenneth L. Ketner, and James E. Cook, 3 vol., Texas Tech Press, 1975, 1978, 1979.

The New Elements of Mathematics, edited by Carolyn Eisele, 4 vol. Mouton, La Haye, 1976.

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86

## **Index nominum**

Abélard, P., 3 Agassiz, L., 5 Anselm, saint, 3 Apellicon of Teos, 80 Aristotle, 3, 7, 43, 44, 45, 48, 53, 64, 66, 79,80 Bain, A., 26, 74 Baldwin, J.M., 46, 62, 63, 67, 80 Berkeley, G., 13, 14, 15, 26, 30, 78 Bernstein, R.J., 1 Boole, G., 6, 25, 36, 39, 78 Comte, A., 47 Cantor, G., 44, 69 Darwin, Ch., 4, 26, 27, 64 De Lacy, E.A., 75 De Lacy, Ph.H., 75 De Morgan, A., 3, 24, 25 Descartes, R., 11, 12, 27, 30, 31 Dewey, J., 2, 43 Emerson, R.W., 5 Epicure, 43, 45, 64, 66, 78 Fay, H.M., 24, 77 Fisch, M.H., 23, 45, 64, 73, 74, 75 Frege, G., 40, 42 Green, N., St.J., 26 Hamilton, W., 73 Hegel, G.W.F. 7, 64, 72 Hobbes, Th., 5 Holmes, O.W., 5

Homer, 45 Humboldt, G. de, 47 Hume, D., 5, 13, 18, 33, 80 Husserl, E. G., 2 James, W., 1, 2, 26, 46, 67, 69 Jastrow, J., 43 Jouffroy, Th., 5, 53 Kant, E., 1, 2, 5, 6, 7, 18, 23, 33, 53, 54, 69,77 Kiekegaard, S., 71 Ladd, C., 43 Lamarck, J-B., 26 Leibniz, G.-W., 1 Lewis, C.I., 2 Locke, J., 5, 13 Longfellow, H.W., 5 Lukasiewicz, J., 59 Lutoslawski, W., 79 Madden, E.H., 74 Marguand, A., 43, 79 Michael, E., 74 Mill, J.S., 5, 35 Mitchell, O., 39, 43, 50, 79 Murphey, M.G., 50, 51, 73, 74, 75 Ockham, G. d', 3, 13 Pearson, K., 54 Peirce, B., 1, 5, 36, 73 Peirce, Ch.S., see Index rerum Peirce, J.M., 36 Perry, R.B., 16, 75

### INDEX NOMINUM

Philodemus, 43, 45, 56, 75, 78 Peter of Spain, 3 Philo of Megara, 42 Plato, 2, 28, 45, 79 Pourtalais, J.A., 24, 78 Prior, A.N., 42 Pythagoras, 45, 79 Reid, Th., 5 Robert, A., 75 Roberts, Don D., 75 Rovce, J., 2, 43 Russell, B., 41, 42, 60 Salisbury, J. of, 3 Saussure, F. de, 2 Schiller, F. von, 52 Schliemann, H., 23 Schneider, H., 55, 75 Schroeder, F.W.E., 2, 79 Scotus, Duns, 3, 6, 7, 14, 15, 16, 23, 43, 64,77 Sheffer, H.M., 38, 41, 59 Smith, B.E., 43

Spencer, H., 47 Swedenborg, E., 5 Sylvester, J.J., 36 Thales, 45 Thibaud, P., 75 Thomas Aquinas, 64 Thompson, M.H., 73, 74 Thomson, W., 5 Turquette, A., 75 Veblen, T., 43 Ward, L., 43 Weiss, P., 1 Welby, V. Lady, 46, 75, 80 Whately, R., 5 Whitehead, A.N., 42 Weiner, Ph.P., 73, 74, 75 Wright, C., 26, 74 Young, F.H., 74, 75 Zenon, 74

## **Index rerum**

Abduction, 36, 60-64 Abstraction, see Precision Action, 26-36, 49, 52 Agapasm, 71 Agapism, 70-71 Anancasm, 70 Anti-psychologism, see Psychologism Argument, 6, 56, 57-58, 61-62, principle of -, 6 Aristotelicity, 69 Assertion, 51 Association of ideas, 14 Axioms, 42 Being, 7, 8, 9, 15, 50 Belief, 26-28 Calculus, 58-60, 75 note 44 Cartesianism, 11-19 Categories, 7-11, 48-52, 64-72; see Firstness, Secondness, Thirdness; hierarchy of -, 55-56 Causality, 14, 35 Chance, 20, 27, 35-36; absolute -, 65-70 Chemistry, 36 Clarity, the three degrees of -, 31-32 Classification of the sciences, 46-48 Common sense, 72 Community, 16, 18-19, 20-21 Comparison, 9 Conception, 9-10, 14 Consciousness, 12, 68-70 Contiguity, 14 Continuity, 14-15, 33, 50, 58, 67-70 Continuum, 74 note 14 Copula, 7, 26; see Proposition

Correlate, 8, 10-11, 19 Creation, 71 Deduction, 19-21, 37, 60-64 Degenerate, 49 Diagram, 37, 61, 63 Dicisign, 56 Discrimination, 7, 8 Dissociation, 7, 8 Distinction, 7 Doubt, 27-28 Dualism, 15, 17 Empiricism, 13 End, 53-54 Esthetics, 52, 55 Ethics, 52-56 Evolution, 26, 65, 70 Evolutionism, 64 Evolutionist cosmology, 64-72 Existence, 51; see Secondness Existential graphs, 36, 59-60 Experience, see Thought as process; pure -, 15; — of the three universes, 64-72 Fact, 28 Fallibilism, 23, 63, 72; and continuity, 72 Feeling, 29, 51, 52, 66, 68 First, 10-11, 17, 48-52 Firstness, 48-52, 64-72 Fourthness, 55 Functions (logical), 38-39, 59-60

Freedom, 71; see Absolute chance

### INDEX RERUM

Generals, 3, 16, 55; see Universals Genuine, 49 God, 71-72 Grammatical subject, 50-51 Ground, 8-11, 56

Habit, 14, 26-36, 65-66 Haecceitas, 51 Human species, 54

Icon, 10, 11, 37, 42, 50, 56, 57 Idealism, 7, 11, 13, 18, 20 Idea, 26, 55-58, 67-69; clear and distinct -, 29-34 Identity, 40 Immortality, 71 Implication, 38; philonian or material -, 41-42, 58; formal -, 58 Inclusion, 38 Incognizable, 11, 12, 15-16 Index, 10, 11, 50-51, 59-64 Individual, 50, 51, 57; see Secondness Induction, 19-21, 27, 28, 33-36, 60-64 Inference, 11, 13, 27, 60-64; statistical -, 21 Interpretant, 9, 10, 11, 56-58 Introspection, 8, 11, 12 Intuition, 11-19 Inquiry, see Research Judgement, 6; see Assertion Kanticity, 69 Knowledge, 11, 12, 26-36 Law: natural, 65-66, see Order of nature; conception of -, 27 Legisign, 56-57 Life, 67, 69, 70, 72; see Absolute chance Likeness, 11 Logic, 38-43, 56-64; social character of -, 19-21, 34; moral nature of -, 20-21; formal -, 58-60; symbolic -, 36-43;

Boolian -, 38-39; — of terms, 39-40;

propositional -, 40-43; - of relations,

24-25; — of graphs, 75 note 44, see Existential graphs; trivalent -, 59; law of -, 19-21; system of axioms, 42-43. Love, 70-72

Man-sign, 18-19; see Human species Materialism, 18 Matter, 70 Mathematics, 36-38, 63 Meaning, 19, 31, 64 Memory, 68 Method, 27-28; scientific — , 28-32 Methodeutics, see Speculative rhétoric Mental association, 14; and association of ideas, 14 Mind, 17, 65, 70 Musement, 71 Natural selection, 36 Nature: order of -, 20, 32-36 Neutralism, 26-72 Nominalism, 5-7, 8, 11-19, 20, 33, 37, 64, 67-70 Object, 10, 11, 56, 57; transcendental -, 13 Perception, 29, 33, 67-68 Phaneron, 51 Phaneroscopy, see Phenomenology Phenomenalism, 11, 18 Phenomenology, 48-52, see Categories Possibility as mode of being, 69-70 Possible, 35-36, 37, 57, 69 Pragmatism, 26-36; pragmatic maxim -, 30.54

Pragmaticism, 72

Precision, 7-11, 12

Predicate, 7, 51; see Rheme

Probability, 27, 33-36, 60-64 Proposition, 7, 24-25, 38-43, 58, 73 note 14

Psychologism, 8, 11

Quale, 10

### INDEX RERUM

Qualisign, 56 Quality, 8, 9, 18, 49, 51, 56-58 Quantifier, 39-40 Real, 16, 21, 31 Realism, 7, 11-15, 19 Reality, 13, 15-16, 17, 18-19, 19-20, 28, 31-32, 63, 65 Reason, 28, 55 Reasonableness, 70 Reasoning, hypothetical — , 12-13; mathematical - , 63 Reference, 8, 9 Research, 26-36 Relate, 9, 10, 11, 25 Relation, 8, 9, 24-25, 51; monadic -, 50, 52; dual -, 50; triadic -, 49, 50, 52, 56 Religion, 71 Replica, 57 Representamen, 10, 11, 56, 57 Representation, 9, 10, 14, 52 Resemblance, 14 Rheme, 57-58 Rule, 57 Science, see Classification; Normative -, 52-64 Scientific metaphysics, 35, 64-72 Second, 10, 11, 17, 48-52 Secondness, 48-52, 64-72 Semiosis, 56, 60

Semiotic, 56-58 Sensation, 17, 29 Sentiment, 28, 51 Sign, 10, 11, 11-12, 18-19, 49-51; classes of -, 56-58 Signification, 58; rule of -, 57 Similarity, 8 Sinsign, 56-57 Sophisms, 73 note 14 Space, 69, 70 Substance, 7, 8, 9, 51 Syllogism: figures of -, 6; syllogistic process -, 13-14 Symbol, 10, 11, 52, 56, 57-58 Synechism, 51, 67-70, 72 Time, 70 Third, 10, 11, 18, 48-52 Thirdness, 48-52, 64-72 Thought, 33, 51; as a process, 11, 12, 13, 14, 19; - sign, 14 Trichotomies of signs, 56-57 Truth, 32, 34, 56, 64; - values, 41; tables, 58 Tychasm, 70 Tychism, 65-67 Universe, 36, 64-72 Universals, 3; see Generals

World, see Universe