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The First Moment of Scientific Inquiry: C.S. Peirce on the Logic of Abduction

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The First Moment of Scientific Inquiry: C. S. Peirce on the Logic of Abduction

I. Introduction

C. F. Delaney has suggested that the first or abductive phase of Peirce's general characterization of scientific method can be distinguished into two "moments." The first is concerned with the original generation of those hypotheses which will form the set of potential explanations for the phenomena under consideration, and is a function of the creative imagination of some (gifted) individuals. As such it cannot be reduced to strict formulae or procedural rules. The second moment is concerned with the preferential ordering of the hypotheses in this set in relation to considerations bearing on the economy of research. This moment of the abductive phase is rule-governed, with features such as "simplicity" supplying the requisite selectory criteria.¹ This distinction is a useful one for coming to understand more fully Peirce's account of the abductive phase of inquiry in relation to the grounds of validity undergirding the scientific enterprise as he conceives it.

While Delaney's paper deals primarily (though not exclusively) with the second moment, the present paper focusses especially on the first moment, which is used as a point of departure for a more wide-ranging investigation of some of the characteristic features of Peirce's thought related to his philosophies of mind and nature. Following a brief review of Peirce's general theory of the stages of scientific inquiry, we proceed to examine his view of the role and importance of the abductive phase within the scientific enterprise. He thinks that this phase rests ultimately upon a particular faculty or instinct man possesses which permits him a certain insight into the most general structural features of nature. Since the scientific enterprise as he conceives it rests ultimately upon this faculty, it is appropriate to inquire further into the grounds of its validity. We

shall suggest that Peirce offers at least three distinct explanatory accounts of this faculty. After discussing each of these accounts individually, we shall suggest how they can be seen as representing characteristic features of Peirce's distinctive approach to human knowledge. The working assumption throughout this paper will be that Peirce is an important philosopher whose often enigmatic remarks are nonetheless worth taking seriously. Such an attitude would seem to entail not only accurately presenting ideas from his various available papers, but also attempting to draw together and relate some of these ideas to one another, to *organize* them in some fashion, in a way that he himself never did, in order to render explicit the potential unity and coherence of his thought. Rather than treating his scattered remarks as haphazard and unrelated to one another, therefore, they will be seen as distinct threads woven into the fabric of his unified philosophy.

II. *The Logic of Abduction*

S1. Peirce's General Theory of Scientific Inquiry

While our primary concern is with Peirce's understanding of the logical validity of the first moment of the abductive phase of inquiry, it may not be amiss to begin by situating the abductive phase within his general theory of the stages of scientific inquiry. As noted above, the abductive phase could be considered the first stage of scientific inquiry inasmuch as it is concerned with the original generation and recommendation of explanatory hypotheses, i.e., with the positing of specific laws to account for the observed phenomena under consideration. We shall have more to say about this stage in the next section. Peirce terms the second stage "Deduction" in which the hypothesis selected is examined and its consequences are derived. Like the first stage, the second stage also has two parts. The first part consists in logical analysis to explicate the hypothesis and to render it as perfectly distinct as possible. "Explication" is followed by "Demonstration", wherein the inquirer considers more closely the considerations already introduced or involved in the Explication in order to derive its experiential consequents. Deduction having been sufficiently carried out, "the inquiry enters upon its Third Stage, that of

ascertaining how far those consequents accord with experience, and of judging whether the hypothesis is sensibly correct, or requires some inessential modification, or must be entirely rejected" (6.472).² He divides this third or inductive stage into three parts. In "Classification" general ideas are attached to objects of experience; in the "Probations" these ideas are tested with respect to the experiential consequents; and in the "Sentential" part of the Inductive stage the inquirer "appraises the different Probations singly, then their combinations, then makes self-appraisal of these very appraisals themselves, and passes final judgment on the whole result" (6.472).³ This sketch of the three stages of inquiry, while omitting many important details, may nonetheless be sufficient to contextualize the abductive phase within Peirce's more general theory of scientific inquiry. With this as background, we might now turn our attention more fully to his account of the First Stage.

S2. The Abductive Phase

One of Peirce's central concerns in developing his distinctive philosophy of science is with the nature of the logical validity possessed by each of the three stages he discusses. He believes that Kant correctly analyzed the validity of Deduction. The fact that, "This kind of reasoning deals exclusively with Pure Ideas attaching primarily to Symbols and derivatively to other Signs of our own creation," Peirce thinks, plus "the fact that man has a power of Explicating his own meaning renders Deduction valid" (6.474). "Induction," on the other hand, "is a kind of reasoning that may lead us into error." Yet, it follows a kind of method which, if sufficiently persisted in, will lead to Inductive Certainty. The decisive question of the "logical Critic", then, is "What sort of validity can be attributed to the First Stage of Inquiry?" Clearly, given its foremost position in the series of stages Peirce outlines, its justification becomes crucial. Peirce begins his answer by precisely identifying the peculiar importance of this stage in the overall project of scientific inquiry:

Observe that neither Deduction nor Induction contributes the smallest positive item to the final conclusion of the in-

quiry. They render the indefinite definite; Deduction explicates; Induction evaluates; that is all. Over the chasm that yawns between the ultimate goal of science and such ideas of Man's environment as, coming over him during his primeval wanderings in the forest, while yet his very notion of error was of the vaguest, he managed to communicate to some fellow, we are building a cantilever bridge of induction, held together by scientific struts and ties. Yet every plank of its advance is first laid by [abduction]⁴ alone . . . and neither Deduction nor Induction contributes a single new concept to the structure." (6.475)

The problem, then, is the logical validation of those hypotheses which constitute the initial introduction of propositional content into the scientific inquiry. It is clear that without the justificatory grounding of these hypotheses, the conclusions of the second and third stages of inquiry are also cast in doubt, and the edifice of science is set upon a foundation of questionable legitimacy whose conclusions are no better.

The problem here is not unlike that faced by Aristotle in developing his own demonstrative philosophy of science. In order to stay an infinite regress in the order of demonstration, it was necessary to secure premises which were not themselves the conclusions of logically prior demonstrations. Aristotle's solution to this problem was to say that since scientific knowledge was clearly possible, that man *must* possess a faculty of *epagoge* or intuitive insight into the first principles requisite for a scientific demonstration. Furthermore, the premises thus secured must be certain. Without such an assumption, scientific knowledge and progress would be simply inexplicable.⁵

Peirce faces a somewhat similar problem in justifying the initial elements of scientific reasoning as he understands it. His solution to his own problem is not unlike Aristotle's, in the sense that he too insists that there *must* be access to some basic premises from which to proceed if scientific knowledge is to be attainable. Or, at the very least, the philosopher of science must *assume* that there is such access: "The only justification possible, . . . is the justification of desperation.

That is to say, that if he is not to say such things, he will be quite unable to know anything of positive fact" (5.603). But in keeping with his own avowed fallibilism, Peirce readily concedes that even though we are forced to assume that we have access to such basic premises when engaged in scientific inquiry, still we are not to consider such premises as immutable or as absolutely certain. Rather, "we try them, we compare them with experience, we hold ourselves ready to throw them overboard at a moment's notice from experience" (1.634). Indeed, he thinks that the initial hypotheses, "are so mixed up with error that they can never be trusted till they have been corrected by experiment" (1.404). Clearly for Peirce the abductive phrase does not stand alone in the scientific project, since its products are always responsible to the critical elaboration and evaluation of the other two stages.

Although he begins his discussion of the validity of abduction with the kind of transcendental justification sketched above, he is also convinced that certain quasi-historical considerations are antecedent and lend support to such an account: "There is a reason, an interpretation, a logic, in the course of scientific advance, and this indisputably proves to him who has perceptions of rational or significant relations, that man's mind must have been attuned to the truth of things in order to discover what he has discovered. It is the very bedrock of logical truth" (6.476). What he seems to be most struck by is not simply the static *fact* of scientific knowledge, nor even our present advanced *state* of scientific knowledge, but rather the tremendous *progress* science has made in the relatively brief period in which man has existed. Such progress would be simply inexplicable apart from the assumption of some special faculty associated with the human mind, since, "Nature is a far vaster and less clearly arranged repertory of facts than a census report; and if men had not come to it with special aptitudes for guessing right, it may well be doubted whether in the ten or twenty thousand years that they may have existed their greatest mind would have attained the amount of knowledge which is actually possessed by the lowest idiot" (2.753).

Besides the fact that there *must* be postulated this special aptitude for guessing right if the rapid progress of science is to be accounted

for, Peirce also offers a more properly historical argument in support of this view. In particular, he thinks that a brief perusal of the history of science will bear him out in his belief that such an aptitude has *in fact* been crucially operative in the work of some of the most original and important scientists:

In examining the reasonings of those physicists who gave to modern science the initial propulsion which has insured its healthful life ever since, we are struck with the great, though not absolutely decisive, weight they allowed to instinctive judgments. Galileo appeals to *il lume naturale* at the most critical stages of his reasoning. Kepler, Gilbert, and Harvey – not to speak of Copernicus – substantially rely upon an inward power, not sufficient to reach the truth by itself, but yet supplying an essential factor to the influences carrying their minds to the truth. (1.80; cf. 5.591)

By “the truth” Peirce is referring to the natural laws, the discovery of which constitutes the major achievement of each of the scientists mentioned. If we are to account for the meteoric progress of science conceived as the investigation into the laws which govern natural phenomena, then the proposed mental faculty of “guessing right” must be one which associates the human mind with the natural laws which constitute the formally objective features of nature. That is to say, there must be a “fit” of some sort between the human cognizer and the nomological phenomena science is continually disclosing; for without such a fit the first stage (and hence both other stages) of scientific inquiry, could never be logically validated: “It is certain that the only hope of [abductive] reasoning ever reaching the truth is that there may be some natural tendency toward an agreement between the ideas which suggest themselves to the human mind and those which are concerned in the laws of nature” (1.81; cf. 2.753; 1.121; 2.86; 5.604; 6.531; 7.38; 7.680). Having thus emphasized both the need and the apparent historical reality of such an agreement, the first moment of the abductive phase has been given at least

a *prima facie* justification in terms of a proposed faculty correlating the human mind and the laws of nature. The next step in the logical validation of the first moment would be to explicate the origination of this ability in more detail, perhaps by providing a genetic explanation of some sort. The notion of 'instinct' provides Peirce with a useful *general* account of what he has in mind, and it is to this account that we now turn.

S3. The Instinctual Basis of Abduction

Peirce's initial strategy is to characterize this ability as a species of *Insight* into the general or law-like elements in nature which, though "not strong enough to be oftener right than wrong," nonetheless is "strong enough not to be overwhelmingly more often wrong than right" (5.173). Despite the fair amount of reliability he apparently attributes to this insight, he stresses that, "it has certainly not been [acquired] by a self-controlled and critical logic." Rather, "it is to be referred to the same general class of operations to which Perceptive Judgments belong" (5.173). The "same general class to which Perceptive Judgments belong" is presumably the class of those faculties which operate naturally and pre-critically to provide the organism with important information about its immediate environment. Yet such insight is not identical with perceptual judgment, since it "is at the same time of the general nature of Instinct, resembling the instincts of the animal in its so far surpassing the general powers of our reason and for its directing us as if we were in possession of facts that are entirely *beyond* the reach of our senses" (5.173; emphasis added). Reason is able to draw connections between ideas, and our perceptual faculties are able to provide information about the immediate sensory environment; but instinct provides, as it were, a rule for acting applicable to all conditions sufficiently similar to those in which the organism has developed. Before proceeding to discuss how this instinctual ability functions in the first moment of abduction, i.e., in hypothesis generation, it might be useful to pause here in order to explain briefly what he understands by the term 'instinct'.

Peirce defines an 'animal instinct' as "a natural disposition, or inborn determination of the individual's Nature (his 'nature' being

that within him which causes his behaviour to be such as it is), manifested by a certain unity of quasi-purpose in his behaviour" (7.381, n.19). In man, however, "this behaviour is always *conscious*" and (barring extraordinary stress) is "always partially controlled by the deliberative exercise of imagination and reflexion." The question that naturally arises here is, how is this understanding of human instinct to be squared with his own earlier claim that the faculty of Insight responsible for abduction has not been acquired by a "self-controlled and critical logic"? The important distinction to take note of in this context is that between the primitive acquisition of this ability and one's present awareness of its operation. While the ability was originally acquired non-deliberately and non-reflectively, it *now* functions at least partially on the deliberative and reflective level of consciousness. It is neither wholly non-rational nor wholly spontaneous. Rather, on the one hand, "to the man himself the instinctual action appears to be entirely rational." But on the other hand, "the adaptation of the behaviour to its quasi-purpose in some definite part overleaps all control" (*ibid.*). Peirce's understanding of human instinct thus has three essential features: (i) "it is conscious," (ii) it "is determined to a quasi-purpose," and (iii) "in definite respects it escapes all control" (*ibid.*). But if Peirce wishes to explain hypothesis generation in terms of a certain instinct as above specified, we should still want to know how this instinct *itself* is to be accounted for. Our next concern, therefore, is to consider how he *explains* such an instinct in the first place. Actually he offers three distinct explanations for this instinctual ability to non-discursively grasp the general nomological features of reality, each of which we will examine in turn.

S4. The Argument from Adaptive Value

In the first place, Peirce thinks that this particular instinct, like every other instinct possessed by animals, can be explained in virtue of a certain *adaptive value* associated with it: "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). The idea here seems to be that if not the comprehension of the world embodied in actual propositions expressing laws of nature, then at least certain "conceptions" highly important *for* such a comprehension, arise naturally in human consciousness. And such conceptions are here held to be necessary prerequisites for arriving at any further conceptions or complexes of conceptions, i.e., propositions. The emphasis here is on the *general conceptions* which constitute the primary adaptive orientation of the human mind to the world.

Not surprisingly, perhaps, the "Kantist" Peirce mentions specifically such general conceptions as time, space, and force. He then proceeds to suggest an explanation for the possession of such conceptions in terms of their *adaptive value*: "The great utility and indispensableness of the conceptions of time, space, and force, even to the lowest intelligence, are such as to suggest that they are the results of natural selection. Without something like geometrical, kinetical, and mechanical conceptions, no animal could seize his food or do anything which might be necessary for the preservation of the species" (6.418). True, an animal might be endowed with an instinct which served essentially the same purpose, that is, which functioned fairly well given the animal's characteristic habitat, though it made no use of the conceptions of time, space, and force. "But, as that animal would have an immense advantage in the struggle for life whose mechanical conceptions did not break down in a novel situation (such as development must bring about), there would be a constant selection in favor of more and more correct ideas of these matters" (6.418; cf. 4.91, 1.118, 5.45, 5.586, 5.591).

It is important to note here that Peirce is framing his explanation simply in terms of the mechanics of natural selection. The very general conceptions that he wants to attribute adaptive value to are geared toward helping an animal perform efficiently such behaviors as are necessary to maintain it and its species in existence. He is even willing to admit that such conceptions are not strictly speaking *necessary* to an animal's survival, so long as the animal has some *alternative* conceptions which allow it to manage fairly well in its own particular

niche. But those animals with a more *precise* set of mechanical conceptions will have a decided advantage in the struggle for survival over those lacking such conceptions or instincts.

Of course, Peirce's primary interest is with the functioning of these instinctual conceptions in *man*. If greater precision (i.e., nearness to the "correct ideas of these matters") brings with it greater adaptive/survival value, then it would seem that there would be a kind of "push" towards the evolution of certain animals possessing a higher degree of precision in such conceptions, eventually reaching up from very general *conceptions* to a comprehension of fundamental *relationships between* these conceptions. Enter Scientific Man: "Thus would be attained the knowledge of that fundamental law upon which all science rolls; namely, that forces depend upon relations of time, space, and mass. When this idea was once sufficiently clear, it would require no more than a comprehensible degree of genius to discover the exact nature of these relations" (6.418). It would seem on this account that Newton's discovery of the inverse square law, for instance, was *really*, if viewed in the proper perspective, simply a high point in an evolutionary process which began at least with the beginning of the human race and, most likely, with the beginning of the universe. The precision of the concepts and the apprehension of their interrelation were attained through eons of the evolutionary development of (cosmic?) consciousness. Newton's "comprehensible degree of genius" was simply "to discover the *exact* nature of these relations." But if this is to be our explanation of the discovery of natural laws, namely, in terms of the adaptive value of the possession of such an adaptation, we are naturally led to inquire into the degree of adaptive value contributed by such an adaptation. Why should we think that a knowledge of the laws of classical mechanics, for instance, rather than simply an apprehension of the basic conceptions of time, space, and mass and their (rough) interrelations, should contribute anything at all to an organism's survival fitness? It seems rather that such knowledge might actually prove a hindrance in a world in which life depends upon instantaneous behavioral responses to simple and immediate spatio-temporal stimuli. Peirce himself seems to have been sensitive to such a difficulty: "Such a hypothesis na-

turally suggests itself, but it must be admitted that it does not seem sufficient to account for the extraordinary accuracy with which these conceptions apply to the phenomena of Nature, and it is probable that there is some secret here which remains to be discovered" (6.418). It is possible that he is covertly referring to his own doctrine of "synechism," which is at the basis of another of his explanations for the validity of the abductive phase.

S5. The Argument from Synechism

The above account, while clearly grounded in some strong Kantian roots, may suggest, when more fully elaborated, some strikingly Hegelian consequences. One almost gets the sense that for Peirce the universe has evolved to a point at which *part* of the universe is finally able to reflect upon itself: the universe has finally reached the stage of *Self-Consciousness*. This *intimacy* between the laws of nature and man's mind is developed further in his next explanation. It is not surprising, he thinks, that the mind should have this faculty of hitting upon the correct laws of nature, since the mind itself was *formed* by these very laws of nature: "Certain uniformities, that is to say, certain general ideas of action, prevail throughout the universe, and the reasoning mind is itself a product of this universe. These same laws are thus, by logical necessity, incorporated into [its] own being" (5.603). Because man's mind has developed under the influence of the laws of nature, its tendencies are naturally in accord with those laws: "It is somehow more than a mere figure of speech to say that nature fecundates the mind of man with ideas which, when those ideas grow up, will resemble their father, Nature." (5.591, 7.39, 7.508, 7.46). "There can," Peirce states, "be no reasonable doubt that man's mind, having been developed under the influence of the laws of nature, for that reason naturally thinks somewhat after nature's pattern" (7.39).

The idea here expressed, it must be admitted, does not strike the present writer with the kind of luminous self-evidence with which it apparently struck Peirce. Fortunately, he provides an example which is intended to make his meaning "tolerably clear." The particular family of lines called 'straight', he says, has no geometrical properties distinguishing it from any of the other innumerable families of lines

of which there is one and only one through any two points. Now it is a law of *dynamics* that every dynamical relation between two points is similar (except in quantity) to every such dynamical relation between any other two points on the same straight line. Consequently a straight line is the shortest distance between two points, and because of this light appears to move along such lines. This being the case, we recognize them visually and call them 'straight'. "Thus, the faculty of sight naturally causes us to assign great prominence to such lines; and thus when we come to form a hypothesis about the motion of a particle left uninfluenced by any other, it becomes *natural* for us to suppose that it moves in a straight line" (5.603). Here we have an example of how our perceptual apparatus plays a significant role in the kind of conceptual principle that will naturally suggest itself to the inquiring mind. And this, in turn, is simply a particular instantiation of a more general law operative in the formation of our minds: "The reason this turns out to be true is, therefore, that this first law of motion is a corollary from a more general law which, governing all dynamics, governs light, and causes the idea of straightness to be a predominant one in our minds" (5.603). Peirce sums up his view by saying:

In this way, general considerations concerning the universe, strictly philosophical considerations, all but demonstrate that if the universe conforms, with any approach to accuracy, to certain highly pervasive laws, and if man's mind has been developed under the influence of those laws, it is to be expected that he should have a *natural light*, or *light of nature*, or *instinctive insight*, or genius, tending to make him guess those laws aright, or nearly aright. This conclusion is confirmed when we find that every species of animal is endowed with a similar genius. . . . (5.604)

Here again we have the idea that man's ability to "guess aright" the laws of nature is to be placed on a continuum with the instincts all animals are endowed with, albeit of a very high order. But he here links this idea with another which seems to be logically distinct from

it: that a partial explanation of man's ability to guess aright the laws of nature is a function of the fact that man's mind, no less than every other entity existing in nature, has itself been formed by these very laws. But if nature is essentially material, and the human mind is an immaterial substance, then how is it that the former can play such a significant role in the development of the latter? The answer must be framed in terms of Peirce's distinctive philosophies of mind and nature, according to which natural laws are conceived as "habits" which have become ingrained in the universe, a view which seems strange at first until it is realized that Peirce views matter and mind as simply two poles on a single continuum, with all "material" things exhibiting some degree of mental activity. "[W]e ought to suppose a continuity between the characters of mind and matter, so that matter would be nothing but mind that had such indurated habits as to cause it to act with a peculiarly high degree of mechanical regularity or routine" (6.277). This is, in turn, simply a direct consequence of his doctrine of *synechism*, according to which, "all that exists is continuous" (1.172). Given such a doctrine, then "the reaction between mind and matter would be of no essentially different kind from the action between parts of the mind that are in continuous union. . ." (6.277). In this sense it can be said that, "habit is by no means exclusively a mental fact. Empirically, we find that some plants take habits. The stream of water that wears a bed for itself is forming a habit" (5.492). Transposing this account into the human realm, it is as if the highly pervasive general laws of nature, which are themselves merely "habits" governing effete matter/mind, have left structural traces or grooves in human consciousness and thought thus naturally follows the lines laid down in its very fabric: "Thus it is that, 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 the laws are" (6.10; cf. 1.118, 5.47, 5.586, 5.591, 5.603). In fact, Peirce thinks that without such a natural prompting our ability to discover laws of nature with the precision that we do would be inexplicable.

But actually it is not *quite* as simple as this; for obviously many of

the laws of nature physicists discover, besides boasting of a fair degree of precision, are also highly *complex*. Think, for example, of the laws associated with subatomic particles, relativity theory, and so forth. Peirce admits that, "The further physical studies depart from phenomena which have directly influenced the growth of the mind, the less we can expect to find the laws which govern the mind "simple," that is, composed of a few conceptions natural to our minds" (6.10). And again, "as we penetrate further and further from the surface of nature, instinct ceases to give any decided answers; and if it did, there would no longer be any reason to suppose its answers approximated to the truth" (6.508, 7.606). How then does he propose to explain the generation of hypotheses associated with the often highly non-intuitive natural laws that physicists are continually revealing? The answer is perhaps found in an initially unexpected place.

S6. Laws of Nature and God's Thought

To cover these cases of more complex hypothesis generation it may be that Peirce has one final explanation at his disposal, allied to the previous explanation but also significantly different. He gives a brief hint of it in the following passage:

[E]very scientific explanation of a natural phenomenon is a hypothesis that there is something in nature to which the human reason is analogous; and that it really is so all the successes of science in its applications to human convenience are witnesses. They proclaim that truth over the length and breadth of the modern world. In the light of the successes of science to my mind there is a degree of baseness in denying our birthright as children of God and in shamefacedly slinking away from such anthropomorphic conceptions of the universe. (1.316)

As in the previous explanations he is claiming a sort of intimacy between the objective structural features of nature (natural laws and their conceptual constituents) and the most general cognitive features

of the human mind (conceptions of space, time, etc. and various relationships thereof), with the latter being explained in terms of the former. Here he introduces the notion of man's kinship with God but does not go on to develop how an "anthropomorphic conception of the universe" constitutes a hypothesis concerning scientific explanations of natural phenomena, beyond suggesting that each such explanation implies that there is something in nature to which human reason is "analogous." This could be taken as making the same point as in the previous explanation. In another passage, however, Peirce goes farther and is more explicit: "Were I merely asked to grant that the anticipations of experience involved with (more accurately than "in") induction cannot be accounted for except by the ancient hypothesis that man has been made in the image of his Maker, so far as his Reason goes, I should be compelled to admit this" (2.22). And again, "To believe in a god at all, is not that to believe that man's reason is allied to the originating principle of the universe?" (2.24)

By "originating principle of the universe" Peirce may be saying no more than that man discerns the laws of nature originally established by God, in the sense of apprehending the laws governing natural bodies as these are directed, mediately or immediately, by God's will. Such a view might be indistinguishable from any number of familiar models of divine providence, ranging from deism to occasionalism. But before we rest content with such a conclusion, we should want to know what Peirce means by 'God'. Fortunately, he has no qualms about telling us:

If a pragmatist is asked what he means by the word 'God,' he can only say that just as long acquaintance with a man of great character may deeply influence one's whole manner of conduct, . . . [and] if contemplation and study of the physico-psychical universe can imbue a man with principles of conduct analogous to the influence of a great man's works or conversations, then that analogue of a mind . . . is what he means by 'God' . . . the discoveries of science, their enabling us to *predict* what will be the course of nature, is proof conclusive that, though we cannot think any thought

of God's, we can catch a fragment of His Thought, as it were. (6.502)

This passage is striking in its suggestiveness. We have seen that he compares the relationship between the basic conceptions in human consciousness with the objective general features of reality, i.e., natural laws. Here he seems to be saying that the scientific discovery of a natural law is in a sense "catching a fragment of [God's] Thought." Is he here identifying the objective general features of reality with the order of the ideas in God's consciousness (or mind)? Such an interpretation is tempting, especially in the light of his remarks elsewhere, for example when he says that: "Analogy suggests that the laws of nature are ideas or resolutions in the mind of some vast consciousness, who, whether supreme or subordinate, is a Deity relatively to us" (5.107). This would make God ontologically immanent in nature, however, to a degree to which Peirce, in the light of his various fairly traditional theological statements, would probably be unwilling to go. He was not a pantheist; God is not identical with nature, since He does not exist in time and place as finite things do ("But the God of my theism is not finite. That won't do at all" (8.262).) A more plausible reading, and one which seems more consonant with the wording of the above passage, would be to take God in the sense of a Creator whose thoughts are expressed and displayed *in* His work. Presumably God is a rational creator; man is made to God's image; therefore man has within him the ability to contemplate and intellectually penetrate to some degree the rational plan at work in nature, i.e., God's thoughts expressed in laws of nature. It is not that the laws of nature simply *are* God's thought; rather, it is by contemplating and becoming intimately acquainted with the natural phenomena governed by laws that we catch a glimmering of God's thought. And far from being an *optional* mode of considering the universe reserved for the pious, Peirce thinks that some such attitude is cognitively *necessary* for the regulative aim of science. "Nature only appears *intelligible* as far as its processes are seen to be like processes of thought" (3.422; emphasis added). Nature's most intimate secrets are revealed only to those individual who adopt a certain quasi-reli-

gious attitude toward it, born of long familiarity with its processes. The mystic and the natural scientist on this account, are perhaps closer bed-fellows than it is customary to suppose. Both are making contact with the same Reality behind the appearances. If the *first* moment of scientific inquiry is the initial generation of explanatory hypotheses, then the *last* moment may well be the realization of the *ultimate* explanation behind the conditions necessary for successful hypothesis generation in the first place.

III. Conclusion

Our discussion has obviously taken us a long way from our rather humble initial recognition of two "moments" within Peirce's account of the abductive phase of scientific inquiry. I have tried to sketch what appear to be the main strategies he employs in the justification of this phase. At the same time, an attempt has been made to display some of the conceptual richness of the explanations he brings to bear on the problem. His solution is at once naturalistic, idealistic, and theistic. By putting forth arguments drawn from various scientific, philosophic, and theological doctrines, he is able to present a comprehensive explanation of the foundations of scientific knowledge of astonishing comprehensiveness and power. It is somewhat doubtful, I think, that Peirce's account is unproblematic in all of its details. What is certain, however, is that his account succeeds beautifully in what is perhaps a more vital function: liberating the serious inquirer, for a time at least, from the rather narrow confines which too often characterize even philosophical reflection, thus throwing open the gates to the exploration of more fruitful roads of inquiry.

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NOTES

1. C. F. Delaney, "Peirce on 'Simplicity' and the Conditions of the Possibility of Science," in *History of Philosophy in the Making*, J. L. Thro (ed.) (Washington University Press of America, 1982), p. 178.
2. All references are to the *Collected Papers of Charles Sanders Peirce*, ed. by C. Hartshorne, P. Weiss, and A. W. Burks, 8 vols. (Cambridge, Mass: Harvard University Press, 1931-35, 1958), by volume and paragraph number.
3. The above account follows Peirce's own summary of his doctrine given in: "A Neglected Argument for the Reality of God" (6.468-6.473).
4. For consistency the term 'retroduction' has been replaced with the synonymous term 'abduction' throughout this paper.
5. See *Posterior Analytics*, Bk. 1, chaps. 2, 6, 19-21, and Bk. II, chap. 19. Question: Are Peirce's notions of 'Insight' or 'Instinct' functionally similar to Aristotle's notion of 'Quick Wit' in Bk. II, chap. 34?